This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

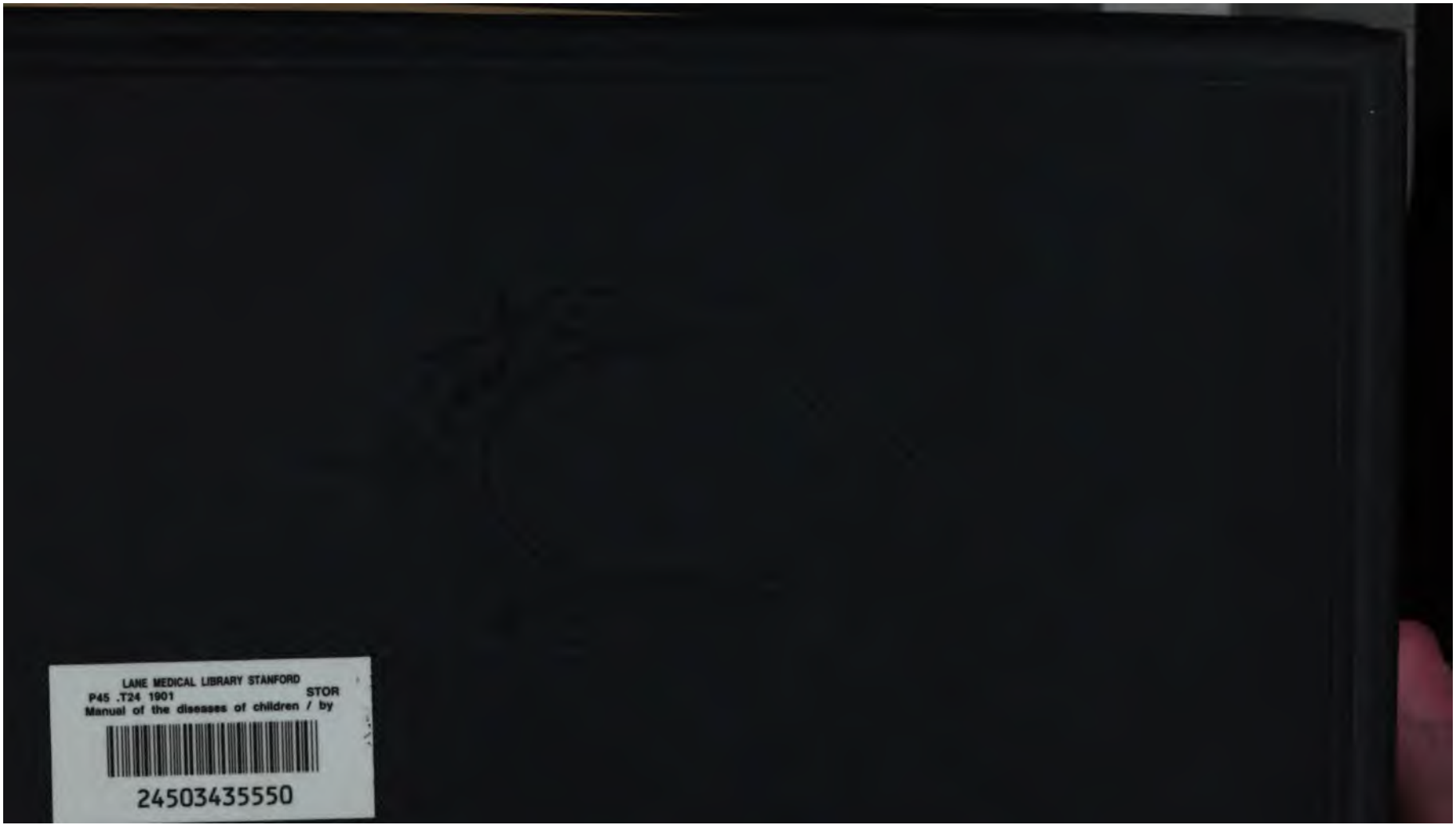
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


LANE MEDICAL LIBRARY STANFORD
P45 .T24 1901 STOR
Manual of the diseases of children / by
24503435550

LAN... ...RARY
STANFO... ...ERSITY
MEDICAL CENTER
STANFORD, CALIF. 94305

LANE
MEDICAL LIBRARY

LANE MEDICAL LIBRARY
STANFORD UNIVERSITY
MEDICAL CENTER
STANFORD, CALIF. 94305

DISEASES OF CHILDREN

TAYLOR AND WELLS

Extracts from Reviews of the First Edition

From "The Brooklyn Medical Journal":

"The authors of this work modestly disclaim for it the title of treatise, but yet it covers in a very satisfactory way the whole field embraced in its subject. The material is condensed and thoroughly up to date. We know of no more satisfactory manual than this one. It is not easy to particularize its excellent features, where there are so many. * * * * "

From "The Medical Record," New York:

"* * * The chapter on general hygiene of infants and children engages the attention. This chapter, while short, nevertheless contains numerous practical and common sense views. The subject of feeding, which is looked for with interest in every work on diseases of children, is taken up from many standpoints. * * * This topic, which seems to be the bugbear of the general practitioner on account of the intricate tables usually given, is here presented in a very readable manner and quite holds the attention. * * The article on diphtheria is one of the best of the series. It is thoroughly up to date and gives what most books on pediatrics do not—a complete discussion from every standpoint of the antitoxin treatment. Again, intubation, which is too often hurriedly passed over in most text-books, finds a very concise presentation in this book. Two plates, one showing the method of after-feeding add to the practicability of the chapter. * *"

MANUAL

OF THE

DISEASES OF CHILDREN

BY

JOHN MADISON TAYLOR, A.M., M.D.

PROFESSOR OF DISEASES OF CHILDREN, PHILADELPHIA POLYCLINIC; PEDIATRIST TO THE PHILADELPHIA HOSPITAL; ASSISTANT PHYSICIAN TO THE CHILDREN'S HOSPITAL AND TO THE ORTHOPEDIC HOSPITAL; NEUROLOGIST TO THE HOWARD HOSPITAL; CONSULTING PHYSICIAN TO THE ELWYN AND TO THE VINELAND TRAINING SCHOOLS FOR FEEBLE-MINDED CHILDREN; FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA, ETC., ETC.

AND

WILLIAM H. WELLS, M.D.

ADJUNCT PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; DEMONSTRATOR OF CLINICAL OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE OF PHILADELPHIA; FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA; MEMBER OF THE PHILADELPHIA PEDIATRIC SOCIETY, ETC., ETC.

SECOND EDITION, THOROUGHLY REVISED AND ENLARGED

Illustrated

PHILADELPHIA

P. BLAKISTON'S SON & CO.

1012 WALNUT STREET

1901

Copyright, 1901, by P. Blakiston's Son & Co.

LANE LIBRARY

WM. F. FELL & CO.,
ELECTROTYPERS AND PRINTERS,
1220-24 SANSOM STREET,
PHILADELPHIA.

T: 4
1 : 1

PREFACE TO SECOND EDITION

The entire book has been thoroughly rewritten, and a number of new chapters and many special articles are added. In other directions the wording has been condensed and some repetitions and elaborations have been omitted which make increased clearness of arrangement. It is now felt that the book will be found to be a succinct presentation of the whole subject of diseases of children.

Attention is called to the remodeling of the articles on infant feeding; these have been almost entirely rewritten, owing to the great advance in our knowledge of the subject, especially in regard to the home modification of milk. The articles on the diseases incident or following birth and the diseases of the digestive organs have been carefully revised.

A chapter on Diseases of the Ear is added; that on the Blood is practically new and as thorough as space will permit. The chapter on Diseases of the Nervous System is carefully revised and several articles added; that on the Skin is again rewritten; also those treating on Infectious Diseases, Diseases of the Heart, and the Respiratory Disorders, much new matter being added.

We are especially indebted to Dr. Geo. C. Stout for assistance in the article on disorders of the ear; Dr. Casper Sharpless, for that on the blood; Dr. Naudain Duer, for that on urinalysis and disorders of the kidney; Dr. Chas. N. Davis, for that on the skin; Dr. Warmuth, for that on variola and vaccinia. To Dr. Alfred R. Allen, Dr. Jesse Williamson, Dr. Charlotte W. West, and Mr. George Ulrich we are indebted for help in various ways. The index was compiled by Dr. Leighton F. Appleman.

101268

PREFACE TO FIRST EDITION

The authors do not claim this book to be a treatise on the maladies of childhood. The original manuscript has in many cases been extensively condensed and several articles omitted so as to reduce the size of the volume to its due proportions as a practical working manual—a brief but competent guide for the student and practitioner. The aims of the authors have been to present in a clear and concise manner the chief points in the description, differentiation, and treatment of the diseases of childhood. The pathology has been abbreviated, not because this most important division of the subject is undervalued, but for the reason that in so small a work there is not sufficient room adequately to describe the constantly increasing discoveries and opinions in this direction. The treatment of the various diseases described is accorded prominence, and has in the majority of cases been dwelt on at length, though the mention of many drugs is avoided. The authors do not attempt to offer much that is original or novel, and only obtrude their individual views when commenting upon the opinions of the great masters in the field of pediatric medicine. The names of few authorities are mentioned. In the preparation of the manuscript several gentlemen have most kindly lent their aid, and to them the thanks of the authors are due. Among these are: Dr. Wm. Johnson Taylor has added much of interest from the standpoint of the surgeon; James Herbert McKee, on diseases of the heart; T. A. Erck, on diabetes, etc.; Joseph Leidy, on scurvy; Carl Seiler, A. V. Watson, and G. H. Makuen, on respiratory diseases. The authors desire also to acknowledge their in-

debtedness to Dr. Van Harlingen for aid in chapter on skin diseases; to Dr. Edwin Rosenthal for his aid in the article on diphtheria and intubation; to Dr. L. S. Ferris for numerous abstracts on the literature of the diseases of the blood, the acute fevers, etc.; and to Dr. L. F. Appleman for the index.

CONTENTS

CHAPTER I.

PAGE

PHYSIOLOGY OF THE INFANT AND CHILD, ... 17
General Symptomatology and Diagnosis of Disease in Children, ... 41

CHAPTER II.

DISEASES OCCURRING AT OR NEAR BIRTH, ... 45
Asphyxia Neonatorum, ... 45
The Management of Infants Prematurely Born, ... 54
DISEASES IN THE NEW-BORN CHARACTERIZED BY HEMORRHAGE, ... 59
Hemorrhages in the New-born, ... 59
Apoplexy in the New-born, ... 60
Hemorrhages from Mucous Surfaces, ... 62
Caput Succedaneum, ... 63
Cephalhematoma, ... 64
Hematoma of the Sternocleidomastoid, ... 67
Umbilical Hemorrhage, ... 69
Gastro-intestinal Hemorrhage, ... 69
DISEASES CHARACTERIZED BY JAUNDICE, ... 70
Icterus in the New-born, ... 70
Malignant Jaundice in the New-born, ... 71
Acute Hemoglobinuria in the New-born, ... 72
Acute Fatty Degeneration in the New-born, ... 73
DISEASES PRODUCED BY SEPTIC INFECTION, ... 74
General Septic Infection of the New-born, ... 74
Omphalitis, ... 76
Tetanus in the New-born, ... 76
Inspiration Pneumonia, ... 77
Sclerema, ... 78
Melena in the New-born, ... 79
Mastitis in the New-born, ... 80
Obstetric Paralysis, ... 81
Umbilical Polypi, ... 84
Diverticulum Tumor and Persistence of the Omphalomesenteric Duct, . . 85
Umbilical Hernia, ... 86

CHAPTER III.

GENERAL HYGIENE OF INFANTS AND CHILDREN, ... 88

CHAPTER IV.

FEEDING AND FOOD OF INFANTS AND CHILDREN, ... 94
Feeding from the Breast, ... 94
Weaning, ... 100

PAGE
Feeding by a Wet-nurse, ... 104
Feeding by the Use of Modified Milk of Animals, ... 105
Decomposition and Bacteriology of Milk, ... 110
The Breeds of Cows Best Adapted for Infant Feeding, ... 119
Supervision of the Production of Milk by Boards of Health, ... 121
Sterilization and Pasteurization, ... 123
Modified Milk, ... 126
Diet of Children from the Sixth to the Eighteenth Month, ... 143
Diet of Children from the Second Year, ... 147

CHAPTER V.

Diseases of the Digestive Organs, ... 155
Diseases of the Mouth, ... 156
Stomatitis, ... 156
Diseases of the Tongue, ... 165
Fibrinous Macroglossia, ... 166
Glossitis, ... 167
Ranula, ... 167
Dentition, Normal and Delayed, ... 168
Diseases of the Esophagus, ... 173
Esophagitis, ... 173
Diseases of the Stomach, ... 174
Gastritis, ... 174
Chronic Gastritis, ... 178
Cyclic Vomiting, ... 183
Pyloric Hypertrophy with Stenosis, ... 184
Ulcer of the Stomach in Children, ... 185
Gastralgia, ... 190
Dilatation of the Stomach, ... 191
Diseases of the Intestines, ... 192
Malformations of the Intestinal Tract, ... 192
Acute Enteritis, ... 193
Chronic Enteritis, ... 195
Acute Milk Infection, ... 200
Subacute Milk Infection, ... 206
Ileocolitis, ... 211
Amyloid Degeneration of the Intestines, ... 218
Mucous Disease, ... 218
Chronic Constipation, ... 224
Intestinal Colic, ... 227
Intestinal Obstruction, ... 230
Hernia, ... 235
Diseases of the Rectum, ... 237
Prolapse of the Rectum, ... 237
Rectal Polypi, ... 238
Prolapse of the Anus, ... 239
Fissure of the Anus, ... 240
Ischiorectal Abscess, ... 241
Hemorrhoids, ... 241
Incontinence of Feces, ... 241
Proctitis, ... 241

CHAPTER VI.

Diseases of the Peritoneum, ... 244
Appendicitis, ... 244
Tuberculosis of the Peritoneum, ... 252
Intestinal Parasites, ... 254

CHAPTER VII.

PAGE
DISEASES OF THE LIVER, . . . 264
Jaundice Occurring During Childhood, . . . 267
Congestion of the Liver, . . . 270
Physical Signs of Hepatic Abscess, . . . 271
Multiple Hepatic Abscess, . . . 272
Syphilitic Inflammation of the Liver, . . . 273
Suppurative Inflammation of the Liver, . . . 273
Interstitial Hepatitis, . . . 274
Fatty Liver, . . . 278
Amyloid Disease of the Liver, . . . 279
Acute Yellow Atrophy of the Liver, . . . 280
Hydatid Disease, . . . 281

CHAPTER VIII.

DISEASES OF THE GENITO-URINARY SYSTEM, . . . 284
The Urine, . . . 284
Anuria, . . . 285
Polyuria, . . . 286
Physiologic Glycosuria, . . . 286
Indicanuria, . . . 287
Acetonuria, . . . 288
Pyuria, . . . 289
Hematuria, . . . 289
Hemoglobinuria, . . . 291
Enuresis, . . . 291
Stone in the Bladder, . . . 295
Cystitis, . . . 298
Physiologic Albuminuria, . . . 300
DISEASES OF THE KIDNEY, . . . 301
Acute Congestion of the Kidney, . . . 301
Chronic Congestion of the Kidney, . . . 301
Acute Degeneration of the Kidney, . . . 302
Acute Exudative Nephritis, . . . 303
Acute Diffuse Nephritis, . . . 305
Chronic Nephritis, . . . 309
Perinephritis, . . . 314
Pyelitis, . . . 315
Renal Calculi, . . . 316
Tuberculosis of the Kidney, . . . 317
Tumors of the Kidney, . . . 318

CHAPTER IX.

DISEASES OF THE GENITAL ORGANS, . . . 319
Adherent Prepuce and Phimosis, . . . 319
Paraphimosis, . . . 320
Balanitis, . . . 321
Vulvovaginitis, . . . 321
Orchitis, . . . 322
Tubercular Disease of the Testicle, . . . 322
Epididymitis, . . . 323
Hydrocele, . . . 323
Undescended Testicle, . . . 325
Torsion of the Spermatic Cord, . . . 325
Hypospadias, . . . 325
Epispadias, . . . 326

CHAPTER X.

PAGE
DISEASES OF THE BLOOD, ... 327
General Considerations and Definitions, ... 327
Anemia, ... 335
Primary Anemias, ... 335
Chlorosis, ... 335
Simple Primary Anemia, ... 339
Splenic Anemia, ... 340
Leukocythemia, ... 340
Pseudoleukocythemia Infantum, ... 345
Progressive Pernicious Anemia, ... 345
Hodgkin's Disease, ... 349
Secondary Anemia, ... 350

CHAPTER XI.

CONSTITUTIONAL DISEASES, ... 355
Rheumatic Fever, ... 355
Muscular Rheumatism, ... 362
Chronic Rheumatism, ... 363
Rheumatic Phlebitis, ... 363
Rachitis, ... 364
Scorbutus, ... 375
Simple Atrophy, ... 379
Diabetes Mellitus, ... 385
Uric Acid and Uric Acid Conditions, ... 389

CHAPTER XII.

DISEASES OF THE HEART, ... 391
General Considerations, ... 391
Congenital Diseases of the Heart, ... 395
Functional Disturbances of the Heart, ... 398
Organic Cardiac Diseases, ... 400
Diseases of the Pericardium, ... 403
Pericarditis, ... 403
Other Affections of the Pericardium, ... 407
Affections of the Myocardium, ... 407
Myocarditis, ... 408
Diseases of the Endocardium, ... 410
Endocarditis, ... 410

CHAPTER XIII.

DISEASES OF THE RESPIRATORY ORGANS, ... 422
Disorders of the Upper Respiratory Tract, ... 422
Acute Rhinitis, ... 426
Chronic Rhinitis (Simple and Hypertrophic), ... 427
Purulent Rhinitis, ... 428
Atrophic Rhinitis, ... 428
Croupous or Membranous Rhinitis, ... 429
Syphilitic Rhinitis, ... 429
Mucous Polypi (Edematous Fibromata), ... 429
Fibrous Tumors, ... 430
Adenoid Vegetations, ... 430
Acute Pharyngitis, ... 430
Rheumatic Pharyngitis, ... 431
Retropharyngeal Abscess (Retropharyngeal Lymphadenitis), ... 431
Tonsillitis, ... 433
Chronic Tonsillitis (Hypertrophy of the Tonsils), ... 437
Disorders of Speech, ... 437
Croup, ... 440
Membranous Croup, ... 445

PAGE
Laryngismus Stridulus, ... 449
Cough, ... 450
Acute Bronchitis, ... 452
Chronic Bronchitis, ... 457
Bronchial Asthma, ... 458
Pulmonary Emphysema, ... 462
Acute Bronchopneumonia, ... 463
Chronic Bronchopneumonia, ... 469
Croupous Pneumonia, ... 471
The Treatment of Pneumonia, ... 476
Pleurisy, ... 483
Pleuropneumonia, ... 490
Empyema, ... 492

CHAPTER XIV.

Diseases of the Nervous System, ... 495
Nervous Manifestations in the Diseases of Children, ... 495
The Neuron, ... 499
Reflexes—Their Physiology and Significance, ... 500
Motor Excitements, ... 504
Convulsions, ... 504
Tetany, ... 511
Automatic Movements, ... 517
Epilepsy, ... 521
Chorea, ... 528
Insanity and Disturbances of the Mind in Children, ... 537
Imbecility, Feeble-mindedness, and Idiocy, ... 540
Hysteria in Childhood and Youth, ... 546
Hydrocephalus, ... 553
Exophthalmic Goiter, ... 555
Raynaud's Disease, ... 557
Myxedema, ... 558
Migraine, ... 559
Neuritis, ... 561
Multiple Neuritis, ... 561
Diphtheric Paralysis, ... 565
Lead Paralysis, ... 566
Tetanus, ... 567
Simple Cerebral Meningitis, ... 570
Simple Posterior Basic Meningitis, ... 574
Tubercular Meningitis, ... 575
Infantile Cerebral Palsies, ... 578
Tumors of the Brain and Its Meninges, ... 585
Abscess of the Brain, ... 589
Infantile Spinal Paralysis, ... 589
Acute Myelitis, ... 594
Disseminated Sclerosis, ... 599
Hereditary Ataxia, ... 601
Progressive Muscular Atrophies, ... 602
Pseudohypertrophic Muscular Paralysis, ... 603

CHAPTER XV.

The Specific Infectious Diseases, ... 605
Tuberculosis, ... 605
General Tuberculosis, ... 609
Tuberculosis of the Lungs, ... 610
Typhoid Fever, ... 619
Diphtheria, ... 632
Tracheotomy, ... 656

PAGE
Intubation of the Larynx, ... 658
Scarlet Fever, ... 666
Variola, ... 680
Vaccinia, ... 685
Varicella, ... 687
Malarial Fever, ... 689
Epidemic Influenza, ... 700
Epidemic Cerebrospinal Meningitis, ... 706
Mumps, ... 711
Whooping-cough, ... 713
Syphilis, ... 718
Measles, ... 729
Rubella, ... 735
The Bubonic Plague, ... 738
Glandular Fever, ... 741
Care and Treatment of the Hair in Acute Infectious Diseases, ... 741

CHAPTER XVI.

Diseases of the Skin, ... 743
Aphthous Vulvitis of Children, ... 743
Dermatitis, ... 743
Ecthyma, ... 746
Eczema, ... 747
Erythema, ... 760
Furuncle, ... 763
Herpes Zoster, ... 764
Impetigo Contagiosa, ... 766
Miliaria, ... 767
Pediculosis, ... 769
Pityriasis Rosea, ... 770
Psoriasis, ... 770
Purpura, ... 771
Scabies, ... 773
Seborrhea, ... 774
Tinea Trichophytina, ... 775
Tinea Circinata, ... 777
Tinea Favosa, ... 778
Urticaria, ... 779

CHAPTER XVII.

Diseases of the Ear, ... 781
Diseases of the External Ear, ... 783
Diseases of the Middle Ear, ... 785
Diseases of the Internal Ear, ... 791

CHAPTER XVIII.

General Considerations on Physical Development, ... 792
Feebleness in Girls about the Age of Puberty, ... 811

CHAPTER XIX.

Conditions Requiring Surgical Procedures, ... 818
Lymphadenitis, ... 818
Injuries and Shock, ... 822
Harelip.—Cleft Palate, ... 823
Diseases of the Joints, ... 824
Infectious Osteitis (Osteomyelitis), ... 826
Ophthalmia in the New-born, ... 826

INDEX, ... 829

LIST OF ILLUSTRATIONS

FIG.		PAGE
1.	Dissection of a New-born Infant, showing the Size and Position of the Thymus Gland and its Relation to the Lungs,	24
2.	Schultze's Method (Inspiration),	48
3.	Schultze's Method (Expiration),	49
4.	Sylvester's Method (Expiration),	51
5.	Sylvester's Method (Inspiration),	51
6.	Artificial Respiration (Inspiration),	52
7.	Artificial Respiration (Expiration),	52
8.	Ribmont's Tube,	53
9.	Diagram of Tarnier Couveuse,	54
10.	Breck's Infant Feeder,	56
11.	Modification of Tarnier Couveuse, in Use in the Jefferson Maternity, Philadelphia,	57
12.	Section of Cephalhematoma,	65
13.	Hematoma of the Sternocleidomastoid (*From a patient in the Philadelphia Polyclinic*),	68
14.	Diagram Illustrating the Effects of the Persistence of the Omphalomesenteric Duct and the Formation of the So-called Diverticulum Tumor (*Riesman*),	85
15.	A. Marchand's Tube. B. C. Holt's Lactometer and Cream Gage,	114
16.	Feser's Lactoscope,	115
17.	Twelve Per Cent. Cream,	117
18.	Estran's Materna,	140
19.	Gangrenous Stomatitis (*Dr. Stengel's Case at the Children's Hospital*),	162
20.	Macroglossia (*Dr. W. W. Keen's Case*),	166
21.	Diagram Showing the Order of the Eruption of the Milk-teeth,	170
22.	Diagram Showing the Order of Eruption of the Permanent Teeth (*From Rotch*),	171
23.	Subacute Milk Infection (*From patient in the Department of Obstetrics and Diseases of Infancy, Polyclinic Hospital, Philadelphia*),	207
24.	Tænia Nana, von Siebold (*After Leuckart*), × 10,	260
25.	Head of Tænia Nana, von Siebold; with Retracted Rostellum (*After Leuckart*), × 75. A. An isolated hook, × 300,	260
26.	Egg of Tænia Nana, von Siebold (*After Leuckart*), × 300,	260
27.	Tænia Saginata, Goeze (*After Leuckart*),	261
28.	Cephalic End of Tænia Saginata, Goeze (*After Leuckart*)—A in retracted and B in extended state,	261

FIG. PAGE
29. Head of Tænia Solium ; On the Right, Egg of Tænia Solium (*Leuckart*), 262
30. Diagram Showing Reflex Nerve Arc of the Act of Micturition, ... 293
31. *a*. Small Lymphocyte. *b*. Large Lymphocyte. *c*. Transitional Lymphocyte. *d*. Neutrophiles. *e*. Eosinophiles. *f*. Myelocytes. *g*. Eosinophilic Myelocyte, ... 328
32. *a*. Normocyte. *b*. Parasites of quartan fever. *c*. Parasites of tertian fever. *d*. Parasites of estivo-autumnal fever, ... 328
33. *a*. Normocyte. *b*. Normocyte Deficient in Hemoglobin. *c*. Poikilocytes. *d*. Macrocyte. *e*. Microcyte. *f*. Normoblasts. *g*. Megaloblasts. *h*. Poikiloblast. *i*. Microblast, ... 328
34. Human Colored Blood-corpuscles (*After Landois*)—1. On the flat. 2. On edge. 3. Rouleau of corpuscles, ... 335
35. Acute Atrophy (Acute Marasmus) (*From patient in the Department of Obstetrics and Diseases of Infancy, Polyclinic Hospital, Philadelphia*), . . 380
36. Acute Parenchymatous Nephritis and Hematuria, Showing Decided Left Ventricular Hypertrophy ; Area of Dullness Outlined by Auscultatory Percussion, ... 408
37. Girl Aged Eleven Years ; Double Mitral Disease, Area of Dullness Greatly Increased, Especially Over the Left Ventricular Region, ... 411
38. Improvised Croup Tent, Made from an Umbrella and a Sheet, ... 446
39. Tuberculosis of the Lungs Developing during Typhoid Fever, ... 607
40. Skiagram of a Well-developed Male Infant a Few Hours After Birth (O'Dwyer's Intubation Tube Still in the Throat), ... 633
41. Method of Feeding Child after Intubation, ... 659
42. Method of Introducing the O'Dwyer Tube in Intubation, ... 661

MANUAL

OF

DISEASES OF CHILDREN.

CHAPTER I.

PHYSIOLOGY OF THE INFANT AND CHILD.

SIZE AND WEIGHT.

A fully developed infant is one born after a period of two hundred and eighty days' gestation. The average length at birth is from seventeen to twenty inches, or about fifty centimeters, and the weight, as given by different authorities, varies from six to eight pounds (averaging about 4000 gm.). The weight of males is slightly in excess of that of females.

The weight of the infant and child, although subject to slight variations due to many causes, should increase in a regular, definite proportion according to the age. Sudden decrease in weight almost certainly points to some fault in nutrition, the use of improper foods, or the approaching onset of some disease.

The average infant will double its initial weight between the fifth and sixth months, and will treble it at about fifteen months. At seven years the weight is double that of one year, and at the fourteenth year it is double that of seven years. It has been pointed out by Proscher that the growth of the infant during the period of suckling increases in proportion to the richness of the mother's milk in proteids and salts, and that this law applies to other animals as well as to man, the young of those animals whose milk is especially rich in proteids and salts increasing in weight more rapidly than others.

He states that an infant fed on mother's milk with an average of 1.86 per cent. of proteids should double its initial weight in one hundred and eighty days.

The following table will show the gain in weight in grams and pounds from birth to fourteen years :

Age.	Grams.	Pounds.	Average Gain a Day.	
			Grams.	Ounces.
At birth, ...	3000 to 4000	6.6 to 8.8		
From birth to five months, .			20 to 30	⅔ to 1
From five months to twelve months, ...			10 to 20	⅓ to ⅔
At one year, ...	9,500	20.9		
At seven years, ...	19,000	41.8		
At fourteen years, ...	38,000	83.6		

The above table is computed on a basis of 3500 gm. (7.7 pounds) at birth, and of a gain of 30 gm. a day for the first four months and 10 gm. a day for the last eight months of the first year (Rotch).

Boys.		Age.	Girls.	
Height, Inches.	Weight, Pounds.		Height, Inches.	Weight, Pounds.
19.75	7.15	Birth.	19.25	6.93
24.75	14.3	5 months.	23.25	13.86
29.53	20.98	1 year.	29.67	19.8
33.82	30.36	2 years.	32.94	29.28
37.06	34.98	3 "	36.31	33.15
39.31	37.99	4 "	38.8	36.36
41.57	41	5 "	41.29	39.57
43.75	45.07	6 "	43.35	43.18
45.74	48.97	7 "	45.52	47.3
47.76	53.81	8 "	47.58	51.56
49.69	59	9 "	49.37	57
51.68	65.16	10 "	51.34	62.23
53.33	70.04	11 "	53.42	68.7
55.11	76.75	12 "	55.88	78.16
57.21	84.67	13 "	58.16	88.46
59.88	94.49	14 "	59.94	98.23

It is a curious fact that in comparing the weights of children as shown in the above table (which refers to the proportion of height to weight in American children) with those as found in the works of certain English authors, the weight of American seems to be slightly under that of foreign children of the same height and age.

During the first six months the increase in length of the average infant is from 4 to 5 inches; in the second half of its first year the increase is from 3 to 4 inches; during the second year the gain is from 3 to 5 inches; during the third year, from 2 to 3½ inches; and in the fourth year, from 2 to 3 inches. From this time on the increase in length averages about from 1⅔ to 2 inches every year. The length of the child at any given age should bear some sort of relation to its weight; this is shown in the second table on page 18.

Slow or arrested growth, if continuous, is always a sign of some pathologic condition. The most common of these is malassimilation of food, but more serious conditions, such as rickets or syphilis, must be considered. Arrested growth is very commonly found in children affected with chronic diseases of the brain and in cretins.

In infancy the tissues are softer and more elastic than those of the adult or even of older children. The body and limbs are well rounded by a plentiful covering of fat, giving the characteristic plumpness and roundness so familiar in the infantile form. A downy growth, known as lanugo, frequently covers the body at this time; the nails are well formed, and extend to the end of the pulp of the fingers and toes. A glance at the body as a whole will at once reveal the fact that the upper part of the trunk, with the arms and head, is much larger than the lower part of the body, with the exception of the abdomen. The cause of this will easily be seen when we study the changes in the circulation of the blood which follow the cessation of placental and the establishment of pulmonary circulation. It has been taught by the older writers that the general aspect—the roundness of body and limbs, the formation of the nails, the plentiful growth of hair on the head, and the attainment of the average weight—is sufficient evidence of normal development of the infant at birth. Yet observations made on a large number of infants show us that certain parts of the infant's body must attain certain definite relations to one another in regard to size, in order to show that it has attained a perfect state of development. A short rule for computing this is the following: As has been before stated, the length of the average child at birth is about 20 inches, or 50 cm. If the infant is normally developed, the circumference of the thorax should measure one-half the entire length of the body plus 10 (50 divided by 2 equals 25; plus 10, equals 35 cm.). Therefore 35 cm. is the circumference of the thorax in the normal infant. The circumference of the skull should equal the circumference of the thorax plus 2, or 37 cm. (50 divided by 2, plus 10, equals 35;

plus 2, equals 37 cm.). This simple rule is of practical value, and has been tested by the authors in a number of cases. According to Frank, who has made a series of studies on the relative size of the head and of the shoulders of infants born at term, the girth of the shoulders is usually greater than that of the head. When the circumference of the head falls below 32 cm. (12⅝ inches), the child is usually immature. The growth of the finger-nails, the presence of lanugo, and the size of the epiphyses he considers of little importance as diagnostic signs of the maturity of the fetus. Changes in the proportions given above in a majority of cases will point to some abnormality in the development of the child or to the presence of disease; thus, when the circumference of the head greatly exceeds its relative proportion to the thorax and length of the infant, the patient is either rachitic or, more probably, has beginning hydrocephalus. A considerable decrease in these proportions would very probably indicate microcephalus, and if the fontanels are absent or very small, the diagnosis would be almost certain.

An examination of the trunk and extremities of the new-born infant will reveal the fact that the former is ovoid in shape with the larger end below, the greater part of this lower end being taken up by the abdomen, which at this period of life is large in proportion to the rest of the body. The reason for this will be explained when we study the proportionate size of the various abdominal organs, especially the liver, which during fetal life and infancy is of a size out of all proportion to the other abdominal organs. The pelvis and lower extremities are proportionately small and ill developed, while the upper extremities "appear as small, jointed outgrowths from the smaller end of the ovoid trunk."

Usually the first spontaneous act of the new-born infant is a lusty cry. By this means air is inspired into the lungs, which expand for the first time, and thus aid in establishing pulmonary respiration. When nude and lying on its back, we see the new-born infant making almost continuous movements with the legs and arms, accompanied by a certain amount of flexion and extension of the spine. These movements are probably a continuation of those made in the uterus during fetal life. When asleep, the attitude is normally one of complete repose, there being no motion except that of respiration, the type of which may vary considerably even in health.

TEMPERATURE.

At birth the rectal temperature of the infant is about 100° F. (37.5° C.), the axillary temperature being about two degrees lower. According to some authorities, a slight fall of two or three degrees occurs a short time after birth; this, however, in the course of a few hours rises to 98.5° F., which is the normal temperature of the human body. Rotch gives the temperature of the new-born as follows:

At birth,	37 2° C. (99° F.)
Within an hour,	36.1° to 35.5° C. (97° to 96° F.)
In about a week,	36.8° C. (98.2° F.).

There is, however, in all cases a certain amount of variation which must be considered to be within the normal limit. This normal variation is considerably greater in infants than in adults, with the exception of the temperature-ranges seen in women during the puerperal period. In premature infants or in those whose development is under the average at birth the temperature is apt to be below the figures which have been given. Reitz and Finlayson have shown that there is a slight variation in temperature at different times in the day: the highest point being between 5 and 6 P.M., and the lowest occurring during the early morning hours, say between 4 and 5 A.M. It is of importance to remember that in young children trifling causes may often produce considerable increase in bodily heat. An example of this is seen in the fever which accompanies various slight nutritive disturbances.

CIRCULATION.

Previous to birth, the course of the circulation in the fetus is as follows: The fetal blood, separate and distinct from the maternal, flows from the placenta through the umbilical vein and enters the body at the umbilicus, passing thence directly to the liver. At this point a division in the current takes place, part of it passing through the ductus venosus to the inferior or ascending vena cava, the remaining portion going directly into the portal vein and passing through the liver; it then enters the ascending vena cava, whence it goes into the heart at the right auricle. Here the blood currents from the superior and the inferior vena cava empty, but do not unite, and instead of passing into the right ventricle, as is the case in adults, the blood is directed by the Eustachian valve into the left auricle through the opening known as the foramen ovale. Thence it passes into the

left ventricle, and so into the aorta, whence it is finally distributed through the general system. The greatest amount of blood containing the most oxygen is carried by way of the carotid and subclavian arteries to the head and upper extremities; this accounts for the great development of the latter at birth. Returning from the upper part of the body, the venous blood is carried along the superior vena cava into the right auricle, from which it passes through the tricuspid valve into the right ventricle, and thence into the pulmonary arteries in the same manner as in the adult. From the pulmonary artery a small quantity of blood is allowed to pass through the lungs, but the greatest portion of it is carried through a tube which, during fetal life, connects the pulmonary artery with the aorta, and which is known as the *ductus arteriosus.* By this avenue it is carried into the aorta. The amount of blood which passes directly through the pulmonary arteries into the lungs is only sufficient for their nourishment, and the return circulation then passes, as in the adult, through the pulmonary veins entering the left auricle, where it mingles with the blood, passing by way of the foramen ovale, and thus enters the aorta. Subsequently the blood, laden with the excrementitious substances of the fetus, is carried back to the placenta through the umbilical arteries. These are continuations of the right and left hypogastric arteries which arise from the internal iliac arteries. The changes in the circulation following birth and the cutting-off of the placental circulation are as follows: (1) Expansion of the lungs produces, by degrees, a closure of the foramen ovale, thus relieving aortic pressure and producing obstruction of the ductus arteriosus, which gradually degenerates into a fibrous cord. At times neither the closure of the foramen ovale nor of the ductus arteriosus occurs immediately after birth; indeed, the foramen ovale may remain open for a month and the ductus arteriosus for a considerably longer time. (2) The umbilical vein and the ductus venosus become obliterated, usually from the second to the fifth day after birth; ultimately they degenerate and become fibrous cords, the former becoming the round ligament of the liver and the latter a fibrous cord, which in the adult may be traced along the fissure of the ductus venosus. (3) The umbilical arteries change in a twofold manner: the portion between the internal iliac and the superior vesical branch, which supplies the bladder, remains pervious, while the portion between the fundus of the bladder and the umbilicus becomes obliterated,—usually from the second to the fifth day,—and continues as a fibrous cord which forms the lateral ligaments of the bladder. (4)

The Eustachian valve ceases, so far as its function is concerned, almost immediately after birth. Its remains, however, may be traced for weeks or months afterward. In the new-born infant the weight of the blood is estimated at 5 per cent. ($\frac{1}{19}$ to $\frac{1}{20}$) of the entire body weight, while in the adult it is about 8 per cent. ($\frac{1}{13}$) of the body weight.

HEART.

In its early stage of development the heart is so large as to occupy the greater part of the thoracic cavity. According to McClellan, it is at this time much larger, proportionately, than at any later period, or even subsequent to birth. The relative size of its cavities is also different at this time, the auricles being considerably larger than the ventricles, and the right auricle being the larger of the two. As the organ progresses in its development we find the ventricles gradually equal and then exceed the auricles in size. The peculiarities of structure of the fetal heart have already been dwelt upon under the head of fetal circulation; they may, however, be summed up briefly in the following: Between the right and the left auricle we find an oval opening, known as the foramen ovale, which allows the passage of the blood between the two auricles; also the Eustachian valve, which directs the blood coming from the inferior vena cava through the foramen ovale.

After birth and subsequent to the commencement of pulmonary respiration, with the complete establishment of the function and structure of the lungs, we find these organs filling out their natural space in the thorax, and after this the heart attains nearly the proportionate size to the other organs that it does in the adult, and its position will be found, by external examination, to be very nearly the same. It is not, however, covered by the lungs to so great an extent as in the adult, and this difference is caused, partly, by the presence of the thymus gland. External examination during infancy will show that the cardiac impulse is higher and extends further beyond the mammary line than in the adult, and that its apex-beat is often obscure. We know, however, that the apex-beat occupies a higher position and is further to the left side of the thorax in the infant than in the older child. Later in childhood the apex can be made out with great clearness; in fact, is often more distinct than in the adult. It is generally to be heard at the fourth, occasionally at the fifth, interspace until the fourth year. An accurate examination of the valves of the heart is difficult, particularly in early childhood, partly from

FIG. 1.—DISSECTION OF A NEW-BORN INFANT, SHOWING THE SIZE AND POSITION OF THE THYMUS GLAND AND ITS RELATION TO THE LUNGS.

A. Thyroid gland. *B*. Thymus gland. *C*, *C*. Lungs. *D*. Esophagus. *E*. Stomach. Natural size. Dissection made by Dr. F. S. Ferris from a case in his own practice.

the presence of the thymus and partly from the fact of the high position of the heart in the chest causing confusion of the sounds of its valves with those of respiration. It is possible, also, that the heart may change its position with the movements of the body to a greater extent in childhood than in later life.

The heart-beat in the new-born infant varies from 120 to 140 pulsations a minute, girls having a slightly more rapid heart action than boys. According to McClellan, the pulse-rates in subsequent years are as follows :

In the second year, 100 to 115 beats a minute. From the seventh to the fourteenth year, 80 to 90 beats a minute, and after that, 75 to 80. It must be remembered, however, that the normal rate and the rhythm may both be greatly changed by slight causes.

The weight of the heart at birth is about 20.5 gm., or about two-thirds of an ounce.

LUNGS.

The apices of the lungs in children are found by external examination to occupy almost the same position as in the adult: that is, between one and two fingerbreadths above the clavicle. The vesicular sounds are most distinct below the clavicle, while the bronchial sounds are best heard in the upper region of the sternum. Owing to the encroachment of the liver upon the right side of the thorax, a considerable difference is found in the size of the spaces occupied by the right and the left lung, the right lung extending downward as low as the eleventh rib posteriorly, while the lower border of the left lung is found as low as the twelfth rib. Anteriorly, the right lung extends to the fourth or fifth rib, while the lower border of the left lung is found at the margin of the sixth rib. The bronchial portion of the respiratory tract is much more highly developed than the vesicular during early infancy, the vesicular portion consisting merely of small bud-like dilatations at the ends of the lesser bronchi. The connective-tissue element is also found in greater abundance in infancy than in later childhood or in adolescence. The blood-vessels of the lungs are more distensible and tortuous during early childhood than in later life. The air capacity of the lungs is smaller proportionately during early infancy than in late childhood or adult life ; however, we find this increasing rapidly as age advances. According to Schnepf and Wintrich (quoted from

Ashby and Wright), the vital cubic capacity at different ages is as follows:

Three to four years, about	450 c.c.
Five to seven years, about	900 c.c.
Eight to ten years, about	1300 c.c.
Eleven to twelve years, about	1800 c.c.
Thirteen to fourteen years, about	2200 c.c.
In adults (average), about	3300 c.c.

The absorption of oxygen, however, is relatively greater during childhood than in adult life, while the expiration of carbonic acid gas is somewhat less. In new-born infants the number of respirations varies from about forty to forty-five a minute; from this number they slowly decrease until the third or fourth year, when they number about from twenty-five to thirty. At the beginning of adolescence, or about the fifteenth or sixteenth year, they average twenty. The type of respiration in the infant is always abdominal, for the reason that during early life the diaphragm is the largest factor in the production of respiration, the ribs moving but slightly and the abdominal muscles aiding but little in the respiratory movements. Any alteration of this type of respiration is nearly always a symptom of disease in a young child. In later childhood, however, we see the chest participating in the act of respiration, the ribs being raised by the action of the other respiratory muscles or the thoracic muscles of respiration. The action of the intercostal muscles is of slight importance in man. As has been pointed out by Ebner and others, the muscles of inspiration, aside from the diaphragm, are the quadratus lumborum, the serratus posticus inferioris, the serratus posticus superioris, the levatores, the scaleni, etc. The intercostal muscles are chiefly of importance in giving rigidity to the chest. As the child approaches puberty we see the type of respiration varying with the sexes, the abdominal and inferior costal type being found in males and the superior costal type (so called) in females. In girls there is much less movement of the abdomen, while the greater amount of respiratory movement is seen in the upper part of the thorax. The rhythm of respiration may vary considerably in children, especially in the very young. It may, in fact, become irregular without indicating disease. The costal pleura in children is somewhat thicker than in adults, and the inferior margin of the pleura may extend as low as the articulation of the twelfth rib, and sometimes even as low as the transverse process of the first lumbar vertebra posteriorly.

DIAPHRAGM.

The diaphragm occupies a higher position in children than in adults, and is proportionately better developed on account of its importance as an organ of respiration. In regard to its position, Rotch, basing his opinion largely on the observations which Dwight made upon frozen sections, states that in the infant the diaphragm is to be found opposite the eighth and ninth dorsal vertebræ. On the right side it rises higher than on the left, arching over the liver. The lowest portion is that extending along the central or median line. Anteriorly, in the young child it is said to be inserted somewhat above the apex of the ensiform cartilage.

THYMUS GLAND.

This structure lies in the anterior mediastinum immediately posterior to the manubrium of the sternum. It is a long, flattened, lobulated gland, in structure resembling the salivary glands. It attains its greatest development about the second year of life, after which time it disappears rapidly. In color it is pinkish gray, and its weight is about one-half of an ounce. It is richly supplied with blood-vessels. Its function is obscure: by some it is supposed to aid in the formation of the red blood-corpuscles. The undue enlargement of this gland may be accountable for some cases of sudden death in infants.

THORAX.

The thorax in the infant and young child is of much less consequence as a part of respiratory mechanism than it is in the adult. During early life it is somewhat narrower proportionately in its transverse diameter than is the thorax of the adult. The average anteroposterior diameter of the interior of the adult thorax bears a relation to the transverse of 1 to 2½ or 3. In the infant at birth this relation bears a proportion of as 2 is to 3 (Rotch). The thorax is also shorter proportionately from above downward in the infant than in the adult. The sternum in the young child is placed higher than in the adult, the top of the manubrium being on a level with the first dorsal vertebra in the child, while in the adult it reaches to between the second and third vertebræ. In children with rickets the manubrium not infrequently reaches as high as the thyroid cartilages, as in a case seen in Dr. Taylor's clinic. The shortness of the neck so pro-

duced may have important bearing on the operation of tracheotomy and other surgical procedures about the neck. The shape of the sternum during early childhood is said to approach more nearly that of the female than the male. The ribs, too, are more nearly horizontal, and form a larger part of the lateral walls of the thorax during childhood than in adult life. In quite a number of cases a certain amount of variability may be found in the development of the thorax. Especially is this the case in the measurement of the two sides, the circumference of the right side often being greater than that of the left.

The ribs of the child are flatter and more elastic than are those of the adult, but, owing to the inferior development of the inspiratory muscles, they are raised but slightly during respiration, unless the breathing is forced. As has been already pointed out, respiration in the child is chiefly accomplished by the action of the diaphragm, so that the movement of the thorax is comparatively small. The bones of the thorax are subject to various deformities, caused by the influence of disease. Thus, in rickets we may have a formation of bony protuberances at the junction of the ribs and the costal cartilages, or from extreme softness of the structure there arises a narrowing of the chest with a protuberance of the sternum, causing the deformity known as *pigeon-breast.*

ABDOMEN.

The abdomen of the child is more protuberant and is of a larger size relatively than that of the adult, owing, chiefly, to the greater size of the liver during early life. This organ, as has already been explained, occupies almost the entire right side of the abdomen, and, according to McClellan, has a relative weight to the whole body at birth of about 1 to 8. Its lower border, with the child in the upright posture, reaches nearly to the crest of the ilium, and its left lobe extends across to the costal cartilages of the left lower ribs. In the middle line the liver is in close relation to the skin in front of the stomach, and reaches half way between the ensiform cartilage and the umbilicus. Its lower edge corresponds to a line drawn from the ninth costal cartilage on the right side, to the eighth costal cartilage on the left.

SPLEEN.

In the child the spleen can be outlined externally on the left side in the neighborhood of the tenth and eleventh ribs, at which point it is nearest the surface of the body. It must be remem-

bered that the diaphragm always intervenes between the abdominal wall and the spleen itself. In examining the organ percussion may prove of little value, as a distended splenic flexure of the colon may interfere seriously with our study. Auscultatory percussion will here render efficient service, however, and when the spleen can be felt beneath the costal border, we may safely say it is enlarged. The size of the spleen is said to vary greatly, according to the state of nutrition, being much larger in well-nourished children than in those affected by wasting diseases. An exception to this will appear in malnutrition due to syphilis, in which case the spleen is frequently enlarged. The size of the spleen is increased during and after digestion, at which time it contains a large amount of blood. It is covered and sustained by the peritoneum. In front of it are the stomach and the splenic flexure of the colon. When enlarged, it is said that the spleen in childhood encroaches more upon the thoracic cavity than in the adult, this being caused by the greater resistance of the costocolic fold of the peritoneum upon which it rests.

PANCREAS.

Although the pancreas is formed about the second month of intra-uterine life, the starch-digesting (amylolytic) action of the pancreatic secretion is not perfected until about the fourth or fifth month after birth. The fat-digesting (proteolytic) properties, however, are fairly well developed at birth. This has an important bearing on the question of the proper articles of food to be used in early infancy.

The situation of the pancreas is in front of the first lumbar vertebra, behind the stomach, and corresponds with a point about a hand's breadth above the umbilicus.

KIDNEYS.

In new-born infants and young children the kidneys are relatively larger in size and are situated lower than in adults. The latter peculiarity may be explained when we know that the lumbar part of the spine is relatively small at birth. The kidneys lie behind the peritoneum in a considerable quantity of fatty tissue, which helps to hold them in position. Owing to the large size of the liver, the right kidney is situated lower than the left. The kidney in children is more lobulated than in the adult, and the suprarenal capsules are much larger—indeed, in young infants they sometimes almost cover the kidney.

During the first year or two of life the kidneys attain nearly the same position and relations as in the adult.

The *bladder* in the child is practically an abdominal organ. When distended, it occupies nearly the whole of the lower portion of the abdomen, and this is an important fact to be remembered in making an examination of the abdominal organs of a child. Before such an examination the bladder must always be emptied.

The shape of the bladder is ovoid, with the larger end resting in the pelvis. As the pelvis increases in size the bladder becomes more and more accommodated within its cavity, finally becoming one of the pelvic organs. In the child the peritoneum is reflected entirely over the posterior surface of the bladder, and extends to behind the urachus downward to the neck of the bladder, and thence to the upper part of the rectum. The anterior surface of the bladder is always covered by peritoneum. The bladder is capable of great distention, cases have been reported where the summit of the organ has reached the umbilicus, and even extended to the ensiform cartilage.* The *prostatic gland* is very small during early life.

The *quantity of urine* secreted increases rapidly for the first five days after birth. From that time the increase is slow. The average amount excreted by a child of four or five days is about twelve to fifteen ounces, averaging 420 c.c. At two years of age the daily excretion will average fifteen ounces, or 500 c.c., and at four years eighteen to twenty ounces, averaging about 600 c.c. According to most authorities, the urine at birth is more concentrated, and therefore of a higher specific gravity, than that secreted after the infant has begun to feed from the breast; it will, however, vary considerably with the amount of water the child is allowed to drink. As a rule, however, the specific gravity is lower in infancy and early childhood than in adult life. It may vary from 1005 to 1010. It is curious to note that in the kidneys at birth there is often a peculiar reddish discoloration of the papilla, which is caused by the presence of uric acid crystals and urates. It would seem as if this deposit was particularly marked in those children who have not had a normal supply of oxygen at birth. During early life the urine may be turbid and dark, but later it becomes clear and of a light-yellow color. The excretion of urea is relatively smaller in children, and the same is also true of the chlorids and phosphates. Occasionally traces of albumin

* In a case reported by Dr. J. M. Taylor the upper surface of the organ reached as high as the diaphragm.

may be found in the urine during the first few days of life, but these will soon disappear.

STOMACH.

The stomach is placed more vertically in the infant than in the adult; in fact, its axis is more nearly vertical than horizontal or transverse. Its shape at birth is more tubular than in later childhood or in the adult. As is well known, the cardiac orifice of the fully developed adult stomach is protected by a valve which prevents the regurgitation of fluids into the esophagus. In infants, however, this valvular constriction is deficient, and it is owing to this and to the vertical position of the stomach that regurgitation of fluids so much more frequently occurs in infants. Indeed, this is nature's way of relieving overdistention. At about the middle of the first year of life the stomach is relatively broader than at any later period; the fundus is, at this time, but slightly developed. The capacity of the stomach at birth is very small, nearly all authorities giving it as being less than one ounce. The size and capacity of the organ seem to vary somewhat with the weight of the child. During infancy the stomach is capable of considerable distention, and it has been found that the stomachs of babies fed continuously on artificial food have a greater capacity at any given age than those fed by the breast. On the other hand, it seems probable that the use of too small quantities of food has a tendency to cause contraction of the stomach, thereby decreasing its capacity. Following birth the growth of the stomach is quite rapid for the first three months of life. This is followed by a period of about two months in which the increase in the gastric capacity is slight. After this time, however, there is a regular and steady increase in size until adult life is attained.

According to Rotch, the increase of gastric capacity is as follows:

3 hours old,	capacity ⅛–1 oz.	25–30 c.c.
4 weeks old,	" 2½ oz.	75 "
8 weeks old,	" 3¼ "	96 "
12 weeks old,	" 3⅓ "	100 "
16 weeks old,	" 3⅔ "	107 "
20 weeks old,	" 3⅘ "	108 "

An accurate study of the capacity of the stomach of infants is of great practical value in aiding the physician to regulate the quantity of food which should be given. As the experience of those interested in the scientific feeding of infants increases, the

necessity for such accurate knowledge becomes of more and more importance.

As an organ of digestion, the stomach does not play so important a part in infancy as in adult life. This is said to be owing partly to its more perpendicular position in the infant, and also to the fact that at this period of life the gastric juice is but scantily secreted. When milk is taken, the curd is quickly coagulated by the rennet ferment,—this taking from ten to fifteen minutes, — after which it is acted on by the pepsin and hydrochloric acid, but before digestion is complete a large portion is passed into the intestine, where digestion is completed. According to Holt, a large portion of the milk passes from the stomach into the intestine in young infants during the first half hour, and at the end of an hour the stomach is empty.

The duration of gastric digestion varies with the age of the infant and the food given ; as a rule, human milk is more quickly digested than cow's milk.

The gastric juice of the infant contains pepsin and hydrochloric acid as in the adult, and lactic acid is also occasionally found, but all these elements, and especially free hydrochloric acid, are in much smaller proportion during infancy, and it is supposed that this scanty secretion of hydrochloric acid probably explains the feeble germicidal properties of the gastric juice of infants and the susceptibility of these patients to gastro-enteric infection.

SMALL INTESTINE.

The average length of the small intestine in the infant at birth is 9½ feet. According to Rotch's measurement, it is 287 cm., although he states that he has seen a variation of 61 cm., or about two feet. During the first month of life this increase in length is about the same, but after that time its growth is irregular. During childhood the upper part of the small intestine usually occupies the left iliac fossa, while the lower part is found in the iliac fossa of the right side. In the first part of the duodenum the glands of Brunner are placed, while in the portion below the duodenum the patches of Peyer can be found, often at a very early period. In the small intestine the process of digestion is continued by the action of the pancreatic juice and other secretions. The fat of the food is here emulsified, and absorption of elements whose digestion was begun in the stomach takes place.

LARGE INTESTINE.

At birth, according to Treves, the large intestine measures about one foot, ten inches, or fifty-six centimeters, in length. Rotch states that there is very little variation in these measurements—not more, in his experience, than five inches, or 12.7 cm. It is generally taught that there is comparatively little increase in length in the first three or four months of life, but during this time the whole intestine grows more rapidly than does the sigmoid flexure, which at birth forms about one-half the entire length of the large intestine—indeed, it is stated that the sigmoid flexure actually diminishes in size owing to a readjustment of the mesentery (McClellan). Treves states that at the end of the first year the large intestine measures two feet, six inches, or 76 cm. in length ; at six years about three feet, or 91.5 cm., while at thirteen years its length will be three feet, six inches, or 107 cm. The course of the colon is from the right iliac fossa upward to the liver, from which point the bowel passes transversely in somewhat of an arch across the abdomen to the spleen, forming, as it curves, the hepatic flexure, the splenic flexure, and the sigmoid flexure, the latter curve occurring in the left iliac fossa. Beyond this point it terminates in the rectum. Not infrequently its course may lie diagonally across the abdomen, from the hepatic region to the left groin. In children the transverse colon, when distended with gas or fecal matter, can be quite clearly outlined by percussion.

CECUM.

The cecum occupies a higher position in the child than it does in the adult, and is also somewhat shorter in the former than in the latter. In thirty out of thirty-five cases examined by Rotch the position of the cecum varied from the right lumbar region to the lower part of the right iliac fossa. It is completely invested by peritoneum except on its posterior surface. As to whether or not the peritoneum covers the latter site, authorities differ ; thus, Treves, in his Hunterian Lectures, states that in 100 observations he always found the peritoneum infolding the cecum on its posterior surface, and Dwight (quoted by Rotch) found that out of thirty-seven young children the cecum was completely covered with peritoneum in thirty-three cases, and in the other four cases the largest part of the posterior surface of the cecum was invested by peritoneum. It is stated that during childhood the cecum is much more movable than in adult life.

VERMIFORM APPENDIX.

The position of the vermiform appendix is usually behind the cecum, with its course directed upward and outward. Externally, it can be diagnosticated in case of operation by incising in the semilunar line upon the right side, at a point midway between the umbilicus and ileum (McClellan). In children it can sometimes be outlined by rectal or recto-abdominal palpation in cases where it is swollen. Great variation in the length and course of the vermiform appendix is frequently seen. It may be wholly or partially covered with peritoneum, the length of the attachments of which may vary considerably.

SIGMOID FLEXURE.

The sigmoid flexure consists of a good-sized loop of the large intestine, which occupies the left iliac fossa, although it is occasionally found in the pelvis ; the mesenteric attachment here is relatively broad, allowing of quite a considerable amount of movement. The point at which the sigmoid flexure of the colon becomes the rectum is of interest from a surgical standpoint, because it is at this point that stricture of the colon is most apt to occur. This is probably due to the arrangement of the bands of peritoneum, the so-called sigmoid mesocolon, which bind the loops of bowel so closely together that twisting on their axes may readily occur.

The lower portion of the large intestine, known as the rectum, is straighter in childhood than during adult life. This is due in part to the straightness of the sacrum at this time. The peritoneum is reflected over the upper portion of the rectum in the same manner as in the adult, except that in the child it is lower down ; the attachments between the rectum and the surrounding parts do not extend so high in children as in adults.

INTESTINAL DISCHARGES.

Following birth, the first discharge from the intestines is of a dark-brown or greenish-brown color, which, from its resemblance to the inspissated juice of the poppy, is called meconium. This substance is odorless, has a somewhat acid reaction, and is composed of partly digested amniotic fluid, cells, cholesterin crystals, and sometimes the constituents of bile. During infancy, while the child is fed on a milk diet, the intestinal discharges are of a

light-yellow color and of liquid consistency, containing about 85 per cent. of water. They are feebly acid in reaction and contain fat, traces of bilirubin, mucus, intestinal epithelial cells, lime salts, and bacteria. In diseased conditions they may also contain false membrane, pus, blood, parasites and their ova, or even foreign bodies. The amount of intestinal discharge during the first few days of life will average from one to two ounces, and the number of stools varies from about two to five a day. As the child advances in age the number of bowel movements become gradually fewer, until the average attains about that of adult life—namely, one or two in twenty-four hours. In color the feces do not change in health until the child begins to take starchy food, when the brown color appears. The bacteria which are found in the intestinal discharges vary in number and species; many varieties have not yet been isolated; however, the proteus vulgaris, the bacillus lactis aerogenes, and Brieger's bacillus may any or all be found. When the infant begins to take a mixed diet, various forms of bacilli appear, among them the streptococcus coli gracilis and others. The color of the fecal discharges varies slightly in health, depending, to a certain extent, upon the character of the food. Certain medicinal agents, especially bismuth, will darken the color of the bowel movements. The color of the fecal discharge is changed greatly in disease; thus we have the characteristic clay-colored discharges seen in certain forms of intestinal disease or in pathologic conditions wherein the bile is not poured into the intestinal tract; the green-colored stool, found in the majority of forms of acute intestinal inflections of moderate severity; and the peculiar watery discharge mixed with shreds of mucus—the "rice-water" passage of acute milk infection.

The bowel movements may be increased or diminished in disease. When abnormally large and frequent, they usually indicate a lack of capacity of the intestine to absorb nourishment; this is found in conditions of low vitality. When the lower bowel is chiefly affected and nutrition but slightly interfered with, the movements are frequent and small.

The characteristic odor of the feces is changed in disease; thus, when acid fermentation is present, they have a sour smell, or when decomposition of albuminoid matter has occurred, they are putrid or highly offensive. Constant feeding on broths will produce the same result from the same cause. The musty odor of the stools of cholera infantum is well known.

Fragments of membrane or, rarely, casts of the intestine are sometimes found in the stools of children suffering from chronic

(croupous) enteritis. Pus is seen in cases of severe ulceration of the lower bowel and in bad cases of chronic enterocolitis. Blood in the stools may be the sign of the presence of an ulcer of the rectum or fissure of the anus; it is also seen in severe inflammation, especially of the lower bowel, and in intussusception. It is not infrequently seen in hemophilia. Dark or partly digested blood may be seen in the stools when the child has sucked from a fissured nipple; it is also a symptom of many other conditions, such as congenital malformation of the bile-ducts and diseased conditions of the liver.

Melena in the new-born is usually accompanied by hemorrhages from the bowels (see description of this disease).

Intestinal parasites and their ova and foreign bodies are frequently found in the feces of children.

THE HEAD.

The average circumference of the head at birth, the measurement being taken on a level with the middle of the forehead in front and the occipital protuberance behind, is about thirteen to fifteen inches, or thirty-four to thirty-seven centimeters. The longest diameter measures at birth about 11.2 inches.

These measurements will, as has been before stated, bear a certain amount of relation to the measurement of the thorax and abdomen, and also to the entire length of the child at term. The shape and contour of the head and general topographic anatomy differ widely from that of the adult; thus we see that the cranial bones during early life are softer and capable of much greater compression than at a later period of development. Between the two divisions of the frontal bones anteriorly, and also between the superior borders of the parietal bones posteriorly, we find an opening caused by the lack of osseous deposit in the bones which form the boundaries of the space. This space is covered by skin and periosteum, and is known as the "anterior fontanel." The situation of this space usually corresponds with the junction of the sagittal and coronal sutures. Posteriorly, at the junction of the sagittal and lambdoidal sutures, is a smaller fontanel, known as the "posterior fontanel." The posterior fontanel usually closes soon after birth, the anterior one remaining open until about the end of the second year, or, more accurately, at about the twentieth month. The size of the anterior fontanel at birth is about 1¾ by 1¼ inches (4 by 3 cm.). According to some authorities, the anterior fontanel increases in size from birth up to about the ninth month, after

which it slowly grows smaller. Occasionally supernumerary bones, called Wormian bones, which may vary considerably in number and size, are found in the sutures between the bones of the skull or sometimes within the fontanels. Their most frequent site is in the course of the lambdoid suture or in the posterior fontanel; they are rarely found in the anterior fontanel. The level of the scalp covering the fontanels is usually about the same or very slightly below that covering the skull generally; this, however, is greatly modified in disease. The pulsations of the cranial circulation can be distinctly felt at the anterior fontanel. The relation which the size of the face bears to that of the cranium is vastly different in the infant from that which we see in adult life. In the infant and during early life the face is much smaller in proportion to the size of the cranium than later. According to Froriep, the proportion between the size of the face and that of the cranium at birth is as 1 to 8, while in the adult it is as 1 to 2. While the height of the orbit bears nearly the same proportion to that of the skull during infancy that it does in adult life, the combined spaces of the two orbits equal nearly half the size of the face in infancy, while in the adult they equal slightly less than one-third. The lower border of the nasal opening during infancy is a little below the lowest point of the orbit, while in the adult it is very much below. The breadth of the skull, measured between the most distant parts of the zygomatic arches, bears a relation to the height of the face of about the proportion as 10 is to 4, this proportion being much smaller in the adult. In infancy the lower jaw is nearly on the same plane as the mastoid process of the temporal bone, and the upper border of the zygoma is on a level with the floor of the nasal cavity. In the adult the upper border of the zygoma is at or near the level of the floor of the orbit (Rotch). The gums of the new-born infant do not meet. A lateral aspect of the skull of the new-born will show that the auditory meatus is situated at a point about the center of a line drawn along its inferior margin, while in the adult it is decidedly posterior to the center of this line. In infants and children the skin of the scalp is thicker than that of any other part of the body, and is closely adherent to the aponeurosis of the occipitofrontalis muscle. The pericranium is but lightly attached to the bones of the skull, being intimately blended at the sutures with the membrane between the soft bones of the child's head; it is lax and admits of extravasations of blood beneath it, producing what is known as cephalhematoma.

The relation between the development of the head and thorax

is exceedingly interesting. The circumference of the head, which is thirty-seven centimeters, or fifteen inches, exceeds that of the thorax, the latter being thirty-five centimeters, or fourteen inches. In the majority of cases this excess in the size of the head continues throughout the entire first year. During this time, however, the thorax increases in size at a more rapid rate proportionately than does the head, until, at the beginning of the second year, we find the circumference of the thorax slightly in excess of that of the head, and from this time on the thoracic circumference continues greater than the cranial.

TABLE SHOWING PROPORTIONATE SIZES OF THE HEAD AND THORAX FROM BIRTH TO THE THIRTEENTH YEAR.—(*Rotch.*)

(The Subjects of these Observations were Male Children.)

Age.	Head.	Thorax.
At birth, . . .	37 cm. (15 inches).	35 cm. (14 inches).
2 years, . . .	48 " (19 ").	51 " (20⅛ ").
3 " . . .	51 " (20⅛ ").	55 " (21¾ ").
4 " . . .	53 " (21 ").	54 " (21¼ ").
5 " . . .	53 " (21 ").	54 " (21¾ ").
6 " . . .	52 " (20½ ").	55 " (21¾ ").
7 " . . .	54 " (21¼ ").	54 " (21¼ ").
8 " . . .	53 " (21 ").	59 " (23⅛ ").
9 " . . .	54 " (21¼ ").	61 " (24 ").
10 " . . .	53 " (21 ").	62 " (24½ ").
11 " . . .	56 " (22⅛ ").	63 " (24¾ ").
12 " . . .	53.5 " (21⅛ ").	63 " (24¾ ").
13 " . . .	54 " (21¼ ").	66 " (26 ").

BRAIN.

At birth the dura mater is closely adherent to the skull; in fact, so intimately are they connected that extravasations can not take place between them. In the subarachnoid space a larger amount of fluid is found during infancy and throughout childhood than in adult life; the quantity of fluid present is generally just about sufficient to fill the space comfortably. McClellan (quoting from Hilton) states that hydrocephalus, due to an excessive amount of fluid in the ventricles of the brain, may be caused by a closure of a small opening in the pia mater, which is found at the inferior boundary of the fourth ventricle, and which is known as the foramen Magendie. The blood-vessels of the pia mater are so exceedingly delicate that high blood pressure, traumatisms, etc., may readily cause hemorrhage into the subarach-

noid space; and from this cause monoplegia, hemiplegia, or diplegia may result. During fetal life and, indeed, from birth up to the seventh year the growth and development of the brain are very rapid, but after the seventh year the growth, although steady, is slow. Cellular multiplication in the cortex of the brain ceases at the third month of fetal life. At birth the weight of the brain is one-third that of the adult encephalon. At the seventh or eighth year the adult size and weight are practically attained, though there may be a slight increase in both up to the twenty-fifth year. This rapid attainment of weight is due to the relatively greater amount of medullary matter in the child's brain; subsequent growth is represented by an increase in the thickness of the cortex and in the size of the cortical constituents, as has been pointed out by Boyd, Veirordt, and Bischoff. At birth the brains of male and female children are practically the same size, but subsequently the brain of the male grows much more rapidly than does that of the female.

One of the most important points of external difference between the brains of the child and the adult is that the fissure of Sylvius, in its relation to the sphenoparietal and squamous sutures, occupies a higher position in childhood than in later life. Both Symington and McClellan found, in a large number of examinations and dissections of frozen sections of the brains of children of various ages under seven years, that the Sylvian fissure was always above the squamous suture and was covered by the parietal bone. The position of the fissure of Rolando is about the same in the child as in the adult. According to Huschker, the cerebellum is much smaller, as compared to the cerebrum, at birth than later in life. The convolutions of the brain in the infant are slightly more shallow and have a much less complex arrangement than in the adult. The depressions or sulci between the convolutions are not so deep in early as in later life. The highly specialized centers of the brain are apparently not fully developed in the young infant.

SIGHT.

From an anatomic standpoint, the eye is fully developed at birth and is sensitive to light. There is no capacity, however, to interpret the images received by it. Apparently, the infant can distinguish light from darkness at a very early age, and shows pleasure in looking at a light or a bright object. About the third month a baby will usually begin to know its mother or nurse, and by the sixth month many objects with which the

child is in constant association can be recognized. The power to estimate distance and to coordinate movements by sight is not developed until some time later. It is said that an infant can not appreciate color until after one year of age. Red and yellow are often the earliest colors recognized. According to Preyer, the movements of the eyes are not coordinated during early infancy.

HEARING.

Apparently the sensation of hearing is not fully developed at birth. It has been stated that this is possibly due to the absence of air from the tympanum and to a swollen condition of its mucous membrane. An infant should be able to hear a loud sound by the end of the second week. Failure to hear sounds as late as the fourth or fifth week may show that the child is deaf or idiotic. The power to appreciate the direction of familiar sounds appears about the third month. The senses of *touch*, *taste*, and *smell* are probably quite well developed at birth. *Sensibility* to touch, temperature, and pain is probably not very acute in early infancy.

LACRIMAL GLANDS.

At birth the lacrimal glands are not fully developed. It is rarely that a baby sheds tears before the third or fourth month. When an infant is seriously ill no tears are shed, and their appearance is said to be a sign of beginning improvement.

SALIVARY GLANDS.

The secretion of saliva is not fully established in the newborn infant, and in consequence of this we find the mucous membrane of the mouth quite dry. The starch-digesting function of the saliva is very slightly present, if present at all, at birth.

THE SWEAT-GLANDS.

Young infants rarely perspire to any marked degree except when overheated, although the skin may be very slightly moist, especially during sleep. Profuse and continued perspiration is usually a symptom of rickets, and this is particularly the case when the sweating is greatest about the head and increases during the night.

SEBACEOUS GLANDS.

As evidence that these glands are capable of performing their function before birth we have the vernix caseosa covering the body of the new-born child. The scalp of the infant may later become covered with a yellowish, scaly secretion known as seborrhœa capitis.

THE TESTICLES.

Under normal conditions the testicles descend through the inguinal canal into the scrotum during the ninth month of intra-uterine life. It is not uncommon, however, to see children in whom one or both testicles are still in the abdominal cavity, and some of these patients will need surgical care. If the descent of the testicles is greatly delayed, a portion of intestine may follow its descent down through the canal into the scrotum.

THE BREASTS.

The breasts of infants of both sexes may be somewhat enlarged at birth, and may contain a milky secretion which, under the microscope, resembles colostrum. Should this secretion become so increased in quantity as to cause great distention of the breasts and pain, the milk should be pressed out by gentle massage and a small breast-binder applied. Great care should be exercised to keep the nipples aseptically clean or an abscess may follow. The condition usually disappears toward the end of the first month.

GENERAL SYMPTOMATOLOGY AND DIAGNOSIS OF DISEASE IN CHILDREN.

In the examination of children, especially those too young to talk intelligently, a method differing from that used in adults must be employed. The young child can, of course, tell us nothing; so that we must rely on the mother or nurse for a history of the case, and it is always well to allow the mother to give the history of the child's illness in her own words before questioning her. During the recital of these symptoms we may closely observe the patient for any symptoms which may aid in the diagnosis of the case. In the first place, a careful history of

the little patient must be elicited. As disorders of nutrition play so important a part in the diseases of childhood and produce symptoms which are often not only severe, but also very obscure, we should obtain all the details of the character, amount, and preparation of its food, together with the frequency of feeding and any changes, and their effects on the child. The condition of the appetite should be noted; whether the child is comfortable after meals or whether it vomits or suffers pain. Carefully ascertain the condition of the bowels through the frequency, color, and character of the movements. This is so important that the physician should make this examination personally. The frequency of micturition should be ascertained and a chemic and microscopic examination of the urine should be made.

Inquire into the time of dentition and the condition of the child during this period, whether the dentition was abnormal or difficult; search after all the symptoms which manifested themselves.

All facts relating to the growth and development of the patient are of importance—thus: the condition of the child at birth, its subsequent growth, at what age it was able to stand, walk, and talk. All previous diseases, especially the infective fevers, should be noted, and whether or not the child is now suffering from any of the sequelæ of these diseases.

In obtaining the history of the present illness, learn the exact character of its onset, time of duration, the presence or absence of fever, restlessness, or pain, with its character. The position which the child assumes when asleep or awake, its cry, the interest it takes in its surroundings, together with all the special symptoms, are of the utmost diagnostic importance. When the illness has lasted some time or has become actually chronic, always inquire into the history of both father and mother—for a history of syphilis, tuberculosis, or other diseases which may be inherited. Examine the other children of the family if there be any. The character of the mother's labors, especially that by which the child under consideration was born, is important.

Posture and General Expression of a Child in Health and Disease.—The posture assumed by an infant or young child is often quite significant of its condition. Before the age at which a healthy infant is able to sit up it will lie quietly or move its limbs in the same manner as during intra-uterine life. Except when hungry or when its napkins require changing it seldom cries. When asleep, it may occasionally lie on its back, although the usual position is on one or the other side, with its thighs, legs, and arms somewhat flexed. Not infrequently an infant may assume a semiprone position. Healthy infants invariably sleep with the

mouth closed, breathing through the nose. The breathing is regular, gentle, and accompanied by little if any play of the alæ of the nose.

The most common cause of disturbed sleep in an infant under four months of age is indigestion, although as the period of dentition approaches disturbed sleep may be a symptom of the onset of this condition. Syphilitic or rachitic infants, as a rule, sleep poorly. Continued restlessness for a number of nights may mean that the child is undergoing an unusually severe dentition, etc., if it occurs at this period of its life. Dentition may even cause a slight rise of temperature, but this symptom should always excite suspicion, as many of the more serious diseases present such a beginning. Difficulty in falling asleep often results from heavy suppers. When the child starts up and screams after having fallen asleep, it probably has night-terrors or is suffering from the results of some fright or nervous excitement which has occurred during the previous day. The child with meningitis also screams during sleep, but its general condition and history, with the fact that patients with meningitis as usually seen are in a state of semicoma rather than sleep, will help to distinguish the disease.

When a child otherwise healthy sleeps continuously with its mouth open, it is a symptom of the presence of enlarged tonsils or adenoids in the nasal canal. The sleep of a hungry infant is disturbed, the child waking frequently and making sucking movements with the lips. The same condition, however, may occasionally be seen in some forms of indigestion.

There are three classes of diseases seen in children which have a more or less typical posture and expression of the face; these are affections of the gastro-intestinal tract, the respiratory system, and of the brain. Each class is distinguished more or less by its characteristic posture, expression, and general appearance, although great variations are often seen. In diseases of the gastro-intestinal tract the child is restless, crying, and peevish. The cry resembles that of hunger, but is kept up, excepting for a few moments after taking food; there is rapid emaciation, especially of the lower part of the face and extremities, with depression of the fontanels. The condition continuing, the face soon assumes the "hatchet type." The eyes are sunken and staring, with deep hollows surrounding them, due to the absorption of orbital fat and probably also to muscular relaxation. The entire body gives an impression of limpness and loss of tone. The expression of the mouth is one of disgust, and around it, in chronic cases, is frequently seen a blue line.

In diseases of the respiratory system, of which we may consider bronchopneumonia a type, the child's face is flushed, the eyes are bright, but the facial expression is dull, anxious, and full of pain. While nursing the child drops the nipple frequently to breathe, attempts to cry, but catches its breath, suppressing its cry because of pain, and coughs with a short, catchy, grunting cough. The cry is short, hoarse, suppressed, and intermixed with coughing. The breathing is rapid, more or less labored, the alæ of the nose dilating widely while the angles of the mouth are lowered and the lips parted so as to admit as much air as possible. When much dyspnea is present, there is recession of the supraclavicular and suprasternal regions, with sinking of the intercostal spaces and, in extreme cases, lateral contraction of the chest-walls. The skin is hot and dry and may be pale, reddish, or somewhat bluish if cyanosis exists. The patient is restless, tosses about, and assumes those positions which favor the ingress of air into the lungs.

Adenoids and diseases of the tonsils generally cause the face to assume a dull expression, sometimes almost vacant. The mouth is constantly open. The child suffers from a persistent running of the nose. During sleep these children generally lie with the mouth open—are "mouth-breathers"—and snore a great deal.

Diseases of the brain, of which acute meningitis is a type, present a different picture. The body is usually more or less rigid—may even be in a state of opisthotonos. There is usually, at least, some retraction of the head. In the later stages there may be general relaxation with complete coma. The facial expression is characteristic: the eyes are closed, the brows are knitted, and the muscles of the jaw are contracted. The general aspect of the upper half of the face has been described as giving the appearance of deep thought, while the tightly closed jaw and retracted head would give the appearance of stern determination. The body is much emaciated, the fontanels are full and bulging, and the eyes may be closed, but more frequently they are unequally open. The pupils are irregular, and there may be strabismus or nystagmus. The cry is a short, sharp shriek and is mostly nocturnal; it is almost characteristic of meningitis; the only cry resembling it is that of chronic bone disease. The skin is generally hyperesthetic, and not infrequently there is a tendency to spasms when touched. The general hyperesthesia of this condition is to be distinguished from the local soreness of scurvy, rheumatism, and disease of the joints.

CHAPTER II.

DISEASES OCCURRING AT OR NEAR BIRTH.

ASPHYXIA NEONATORUM.

Synonyms.—Apparent Death of the New-born; Asphyxie des Nouveau Nes; Asphyxia Pallida Neurosa.

Definition.—Deficient oxygenation of the fetal blood.

Causes.—Asphyxia in the new-born may be divided into (1) antepartum, or intra-uterine, asphyxia and (2) postpartum, or asphyxia occurring immediately after birth. The *causes of antepartum* asphyxia are: Partial or complete detachment of the placenta; interference with placental circulation, such as would be caused by pressure on the umbilical cord, or by the cord being drawn tightly about the child's body or neck; considerable nervous depression in the mother; loss of blood; continued depression of the fetal skull by the maternal parts; premature attempt at respiration by the fetus and consequent inspiration of the amniotic fluid or the secretions of the birth canal. If attempts at respiration during the child's passage along the birth canal are vigorous and prolonged, there may result a form of catarrhal pneumonia, known as "inspiration pneumonia," which may come on a few hours after birth and will probably prove fatal.

Postpartum and Extra-uterine Causes.—The most common cause of asphyxia following birth is imperfect development of the child. This may arise from the fact that the fetus is immature, the respiratory function on this account being so feeble that it can not freely inspire air in sufficient amount to inflate the lungs, thus leaving areas of pulmonary vesicles in an unexpanded condition.

This condition of deficient pulmonary expansion is known as atelectasis. The bony walls of the thorax may be too soft to allow of expansion through muscular action. Simple weakness alone in the child may be a cause of asphyxia following birth.

Disease affecting, by mechanical pressure, the respiratory apparatus, or structural changes in the latter, may be causes. We may also see asphyxia arising from syphilitic disease of the liver or lungs or from pressure produced by dropsy or tumors.

Asphyxia following prolonged birth pressure may be caused by hemorrhage into the fourth ventricle or into the substance of the medulla, thus producing pressure on the respiratory centers. In other cases we may see hemorrhages into the lungs themselves, producing postpartum asphyxia.

Asphyxia of the new-born may be divided into three grades:

1. A slight suspension of respiration, due to an accumulation of mucus or a foreign body in any part of the respiratory tract.

2. There may be observed a type of asphyxia known as the livid, sthenic, or apoplectic form, seen in robust and full-blooded infants.

3. A condition in which the child is pale, limp, and apparently lifeless, and which is known as pallid, asthenic, or anemic asphyxia.

Pathology.—Postmortem examination will reveal patches of extravasation and ecchymoses in various organs, particularly the brain, meninges, and liver. The lungs are dark in color, firmer than normal, and engorged with blood. The air-passages are more or less filled with mucus, amniotic fluid, and meconium where attempts at intra-uterine inspiration have been made.

The cerebral sinuses are engorged with blood, and there is some edema of the membranes covering the brain.

In extra-uterine asphyxia the markings or alterations in the shape of the head will often be seen when pressure has been the cause.

In the lungs, on postmortem examination, areas of unexpanded vesicles will frequently be found. The veins and the right division of the heart are distended. In the head congestion of the cerebral sinuses and meninges, or hemorrhages into the latter, may be present.

Symptoms.—The symptoms of intra-uterine asphyxia can only be determined by close observation of the child while in the womb. On auscultation a very slow or very rapid pulse will indicate either pneumogastric irritation or paralysis.

As the asphyxia continues muscular spasms and unusual movements of the child may be observed. A practical point to be gained from the symptoms is that the movements and heart-beat of the child should be carefully examined before deciding on operative or other methods of delivery. When the umbilical cord is tightly wound about the child's neck or arm, a bruit,

synchronous or slightly slower than the fetal pulse, can be heard by auscultation over the mother's abdomen.

Antepartum asphyxia may be suspected whenever a fetal heart-beat previously regular becomes either very rapid or very slow and faint, or when, by vaginal examination, the pulsations of the umbilical cord weaken or cease, or meconium is passed by the fetus.

The symptoms of postpartum asphyxia vary considerably in the sthenic and asthenic forms. In the *sthenic*, or livid, variety the cutaneous surfaces are cyanotic, the face is dusky or blue in color, the muscles retain their tone, and may be somewhat rigid. Cutaneous irritability is present, and the eyeballs are prominent, with the conjunctivæ injected.

The pulsations of the cord are strong and full, the respirations intermittent, and reflexes may be excited by irritation. In the *asthenic* or pallid form the body is pale and limp and the extremities are quite cool. The face is white and death-like, and the lips are blue. The muscular system is relaxed, and there is little cutaneous irritability. The heart-sounds are slow, irregular, and often so feeble that it is difficult to tell whether pulsation exists or not. Relaxation of the anal sphincter is common. The cord is often thin and pale, while its vessels are nearly empty. This sort of asphyxia is often seen in infants of deficient general development. Not infrequently such a child may make a few irregular spasmodic attempts at respiration, the latter soon ceasing, the heart-beats becoming slower and feebler, and death results, or the child may survive a few hours and then expire.

Prognosis.— The prognosis will depend greatly on the promptness and efficiency of the treatment. Asphyxia in the new-born rarely tends to spontaneous recovery. As a rule, the prognosis in the asthenic form is the more unfavorable. If auscultation for five minutes fails to reveal any heart-beats, the case is hopeless ; otherwise efforts at resuscitation should be continued as long as any action of the heart can be detected. An unfavorable symptom is the continued weakening of the heart and lowering of temperature notwithstanding all treatment. It must be borne in mind in the prognosis that the dangers of asphyxia are not over with the immediate preservation of life, as the child may later perish from atelectasis, inspiration pneumonia, or from the effects of cerebral compression or hemorrhage.

Treatment.—The treatment of asphyxia in the new-born is divided into prophylactic and curative.

The *prophylactic treatment* consists of avoiding, so far as pos-

sible, impediment to the fetal circulation by the correction of faulty presentations, the judicious use of forceps, or, when the child can not be saved by these means, the decision upon suitable operative procedures for its delivery.

Curative Treatment.—When a moderate degree of asphyxia is present, the feet of the child should be grasped firmly and in

FIG. 2.—SCHULTZE'S METHOD (INSPIRATION).

such a manner as to prevent its slipping from the physician's hands, and the head be allowed to hang downward, in order that the blood may gravitate toward the brain. While the infant is in this position the nurse should quickly mop the mouth and upper part of the throat with a piece of soft rag wet with hot water, in order to remove any mucus which may obstruct the air-passages.

The next procedure consists of placing the child in a hot bath at a temperature of about 100° F. (37.8° C.), and pouring or dashing a thin stream of cold water upon the chest or back; slapping the buttocks with a towel wet with cold water is often useful.

If these methods are not successful, the mucus or fluids

FIG. 3.—SCHULTZE'S METHOD (EXPIRATION).

obstructing the air-passages should be removed by suction through a soft india-rubber catheter passed into the trachea. Irritation applied to the skin, or blowing air over the child by means of a bellows or fan, occasionally does good.

If the child still fails to respond, a soft catheter should be passed into the larynx and the lungs inflated, or the same result may be brought about by Richardson's bellows.

When a greater degree of asphyxia exists, any one or all of the following manipulations should be used successively: *Schultze's method* (see Figs. 2 and 3).—The physician, standing with the body slightly bent forward and the legs moderately separated, the arms extending toward the ground, seizes the infant by the axillæ in such a manner that his index-fingers are passed from behind forward, the back of the infant being toward the operator. The thumbs rest gently over the clavicles, against the posterior surfaces of which the remaining fingers are applied in a direction from above downward.

The infant's head is supported against the operator's wrists, who, while thus holding it, quickly raises the infant forward and upward until the operator's arms are somewhat above the horizontal line; the infant's body is now in a state of extreme extension, and inspiration is produced thereby.

At the moment when the operator's arms are somewhat above the horizontal the motion is suddenly stopped, thus allowing the infant's body to flex upon itself in front of the operator's face. This movement flexes the infant's spine and compresses the thorax and abdomen, thus producing expiration.

The infant is now returned to the first position, and the manipulations are repeated at about the rate of from eighteen to twenty times a minute.

Sylvester's Method.—Place the infant on its back, with a small rolled towel between the shoulders, so as to extend the abdomen and thorax. Now grasp the arms above the elbows and bring them quickly upward by the side of the head, at the same time everting them. Next bring them down again against the sides of the chest, and make gentle but firm pressure. The movements should be repeated at intervals corresponding with those of normal respiration.

Laborde's Method.—This consists of laying the child on a flat surface, with a small rolled towel between its shoulders. It is generally recommended that the head and neck be in the state of considerable extension. The tongue is seized with a pair of hemostatic or other small forceps, and drawn out and in with a rhythmic motion, the frequency of which should correspond with those of normal respirations. It is recommended that this traction of the tongue be supplemented by motions of the arms, as in Sylvester's method.

A modification of the so-called Byrd-Dew method will often be found very successful and is to be recommended. This consists in grasping the child by the buttocks with the left hand, holding it in such a position that the head will be lower than the body,

the thumb and forefinger of the right hand being placed around the neck. The left hand then raises the body, bending the latter over, and during this movement the thumb and first finger of the right hand are making pressure against the thorax ; this constitutes expiration. The second movement consists of extending

FIG. 4.—SYLVESTER'S METHOD (EXPIRATION).

FIG. 5.—SYLVESTER'S METHOD (INSPIRATION).

the body or straightening it out, the thumb and first finger of the right hand at the same time releasing their pressure upon the chest-wall ; this constitutes the act of inspiration. The arms may be allowed to hang down, or, better, may be partially supported by the other fingers of the right hand and the body of the opera-

tor. It is well to have the lap covered with a blanket or a rubber sheet in order to protect the clothes. The movement should be repeated from eighteen to twenty times a minute. The faradic current is also very useful in many of these cases.

Mouth-to-mouth Insufflation.—The air-passages of the child hav-

FIG. 6.—ARTIFICIAL RESPIRATION (INSPIRATION).

FIG. 7.—ARTIFICIAL RESPIRATION (EXPIRATION).

ing been cleansed of mucus, the physician places his mouth to that of the child and expires with some force into its air-passages. At the end of each expiration (the child's inspiration) pressure is made on the child's thorax and abdomen, so as to cause the infant to force the air from its lungs. It is unnecessary to close the child's

nostrils during its inspiration. Direct insufflation can sometimes be made by passing a soft catheter into the larynx and gently inflating the lungs, either by expiring into them or by the use of the apparatus of Depaue or Ribmont.

In cases of late asphyxia following nonexpansion of the lungs, our efforts should be directed toward exciting more active respiration.

The stupor which sometimes appears is to be treated by application of hot and cold water to the head and body, or some stimulating liniment may be used.

Unfortunately, the dangers of asphyxia do not end with the resuscitation of the child, and this is especially the case in the pallid or asthenic form. In many of these patients the first respiratory efforts are so feeble that only small areas of the lungs are inflated. What expansion does take place occurs near the surface of the lung. Frequently not enough expansion occurs to allow of the aeration of sufficient blood to support life.

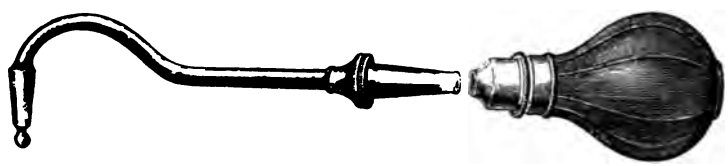


FIG. 8.—RIBMONT'S TUBE.

Atelectasis frequently occurs. In treating the pallid form of asphyxia a good plan is to immerse the infant in a hot mustard bath at a temperature of 110° F. (43.3° C.). A small stream or spray of cold water may be poured on the chest from time to time. In addition to the methods of artificial respiration described, hypodermic injections of minute quantities of stimulants, such as aromatic spirits of ammonia, strychnin, atropin, and brandy may be used with good effect. These patients require careful watching for several days. Artificial respiration and general stimulation should be repeated if necessary.

In the after-treatment the indications are two: warmth and frequent, regular feeding of small quantities of suitable food. Heat at a regulated temperature can be obtained by wrapping the child in raw cotton or wool and placing it in a padded basket near the fire, with one or two bottles of hot water near it and a bath thermometer inserted near the body. A better method is to place the child in the couveuse, or incubator, the one designed by Auvard, or one of its modifications, being about the most conven-

ient. The apparatus consists of a glass-covered box in which a small basket or pillow is placed upon a false bottom on which the infant lies. Warm air is generated beneath the false bottom by means of cans filled with hot water. The air, admitted at a small door beneath the false bottom at one end of the box, is heated by its passage over the cans filled with hot water, then passes up through the chamber in which the child lies, and escapes out through a tube in the top. In this tube a small revolving fan is sometimes placed to secure better ventilation.

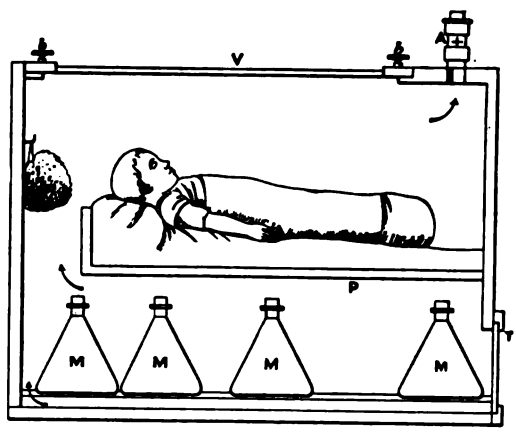


FIG. 9.—DIAGRAM OF TARNIER COUVEUSE.

THE MANAGEMENT OF INFANTS PREMATURELY BORN.

The fundamental principles for the care of prematurely born infants are to be learned from a study of intra-uterine life. The prematurely born infant must be carefully protected from cold and changes of temperature: in other words, it should live in an atmosphere the degree of heat of which is kept as near that of the mother's body as possible. It should receive a plentiful supply of pure warm air, and as the eyes are as yet but incompletely developed, they should be protected from light by keeping the child in the dark. Nourishment must be given by the mouth in the most digestible form possible, in small quantities, and at regular frequent intervals.

Temperature.—A prematurely born infant often loses from five to nine degrees of bodily heat in an hour after birth (Eröss). This rapid loss is partly due, in very premature infants, to the

almost entire absence of subcutaneous fat and to the greater proportionate surface area of the body (Blacker). Another factor to be considered is that on account of the general feebleness of these infants and their weak digestive powers they can not produce much heat in themselves.

Light.—On account of the imperfect development of the eyes, these should be carefully protected from light until the infant has arrived at full term. This can be done by covering the glass top of the incubator with a piece of dark-green or black cloth.

Nourishment.—Every premature infant should be carefully weighed at frequent regular intervals, at first every day, unless it be too feeble. It is only by this means that the increase or decrease in the child's development can be studied. The average daily increase in weight varies with the total weight of the child, and is, of course, less than in full-term children. This increase may amount to from ¼ to ¾ of an ounce a day, and is by no means constant, even if the child be thriving. It must be remembered that these children often remain stationary, as far as weight is concerned, for days at a time; therefore as long as there is no actual loss, no anxiety need be felt. Should a steady decrease in weight occur, the child's life is in danger and a careful investigation must be made for the cause. A very slight loss of weight is sufficient to cause death.

The first indication in the treatment of these infants is to keep them in a warm atmosphere of as nearly even temperature as possible, and this can only be properly done by the use of the couveuse, or incubator, one form of which has been described.

The temperature of the incubator should at first be kept at from 90° to 95° F., according to the general condition of the child: thus, if its extremities are cold or its temperature subnormal, the temperature of the incubator must be raised; on the other hand, if perspiration appears on the child's body, this is at once an indication for reducing the temperature of the couveuse. If the child continues to thrive, the temperature of the couveuse must be gradually lowered, so that when the child is removed, it may not be injured by the temperature of the ordinary room, which is about 70° F.

It is highly essential that the air which the child receives should be as pure as possible; therefore the incubator should be placed in a well-ventilated room. An upper room considerably above the ground-level will generally answer best. The air entering the incubator should be slightly moist and well filtered. In hospitals this can be done by having the incubator supplied with

outside air passed over water or through moist cotton. In private houses a wet sponge placed in a small rack in the incubator, so that the incoming air can pass through it, will answer the purpose quite well. It is generally considered best not to bathe a premature infant, at least during the period of its incubator life; instead it should be enveloped in cotton-wool, which can be changed twice a day or when necessary. Oils and ointments are contraindicated.

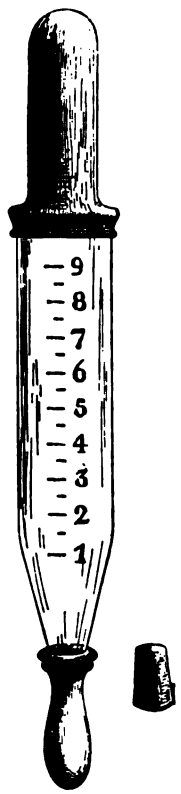


FIG. 10.—BRECK'S INFANT FEEDER.

The feeding is a most important factor in the treatment of these infants; many of them do well on their mother's milk, and in all cases an attempt should be made to feed the child with this. The milk should be drawn from the breast by a clean breast-pump. If the child is old enough to suck, it may be successfully fed by the instrument devised by Breck. This consists of a graduated glass cylinder holding about nine drams. It is shaped at one end so as to hold a small rubber nipple. The large end is covered by a small "cot" or air reservoir. To fill the tube, the rubber nipple and cot are removed, and the opening at the nipple end closed with a rubber plug. The food is then poured in the large end. In feeding the child the plug is withdrawn and the nipple and cot replaced; the nipple is introduced into the mouth, and by gently pressing the rubber cot the food is slowly forced down the infant's throat without any danger of choking it or the expenditure of its strength. If such an instrument can not be had, or if the infant be too feeble to suck, it may be fed from a curved medicine dropper or even by a spoon. If the administration of food by the dropper causes vomiting, the child must be fed by gavage. A small soft catheter is introduced into the stomach, and the food poured in by means of a funnel. This method is, however, much more uncomfortable for the child than feeding by the dropper, and should only be used when all other means have failed.

In some cases mother's milk, even when diluted, will not

agree with the infant, this being explained by the fact that up to the end of pregnancy, and, indeed, for some days afterward, the secretion of the mammary glands is colostrum rather than true milk. This colostral type of milk is nearly always present at the time of or follows premature birth of the child, and analysis of it shows that it contains an excess of proteids with a relative deficiency of sugar and fat. It is on this that its laxative properties and tendency to cause indigestion are supposed to depend.

FIG. 11.—MODIFICATION OF TARNIER COUVEUSE, IN USE IN THE JEFFERSON MATERNITY, PHILADELPHIA.

As a rule, the more premature the birth, the longer the colostral character of the milk continues.

The stomach of the premature infant is a very small and delicate organ, and its digestive fluids are weak ; therefore it is highly important that the food which is put into it shall be such that it can be easily and quickly digested and assimilated. If this is not the case, the child will lose weight and its chances of surviving are much diminished. It is important, therefore, that if the mother's milk, plain or diluted, does not agree from the first, it must be stopped and some easily digested artificial food be substituted for it. Whatever food is used should be given in very small quan-

tities, often not more than a dram at a time, and this must be repeated frequently. The simplest food to use in feeding premature infants is a mixture of equal parts of peptonized milk and barley-water, and of this a teaspoonful may be given every two hours; but much better, in our experience, is cow's milk, so modified that the amount of proteid shall be exceedingly small. Some of the formulas of Rotch will be found very useful for this purpose. As every infant, no matter how young, is a "law unto itself," every patient must be studied with the utmost care. A given milk formula must be studied in the light of the digestibility of each and all of its elements, and when these are taken up by the child's digestive organs and assimilated, the child thrives; otherwise it will rapidly lose ground. If a formula is not agreeing, as a rule the element, be it fat, sugar, or proteid, which is in excess and which is causing the trouble will show itself by the symptoms it produces, and so the reducing of it is an easy matter. As a first milk formula the authors, in common with many others, have had good success with the following prescription of Rotch's:

Fat,	1.00
Sugar,	3.00
Proteid,	0.50
Lime-water,	5.00

This can be made as follows:

Cream,	2½ fluidrams
Milk,	½ fluidram
Lime-water,	1½ fluidrams
Milk-sugar, ¼ measure (or ¾ ounce), or cane-sugar, half the quantity, Pasteurized at a temperature of 167° F.	

The child should receive one dram at a feeding every hour or two. If this agrees, the elements can be very gradually increased, until, by the thirty-sixth week, it is possible the child may take the following:

Fat,	2.00
Sugar,	5.50
Proteid,	1.00
Lime-water,	5.00

This is made as follows (the quantity here given is for an average twenty-four hours' feeding):

Cream,	4 ounces
Milk,	1½ "
Lime-water,	1 ounce
Water,	13½ ounces
	20 ounces
Milk-sugar,	2¼ measures.

If the first formula does not agree, the element in excess must be sought for and reduced. If, on the other hand, the food agrees and the infant does not gain in weight as fast as it ought to, a richer food is demanded. As a rule, some modification of cow's milk which will answer all purposes can be made by the mother or nurse at home. A little patience on the part of the doctor and nurse and some knowledge of the physiology of the infant's digestive apparatus will enable them to make up a food which will meet all requirements. The use of condensed milk, boiled milk, or patent foods, as advised by some authors, we must condemn.

If the infant be very feeble, a few drops of brandy may be given every two or three hours as long as necessary, and if cyanosis should at any time appear, oxygen may be administered for five or ten minutes two or three times a day.

DISEASES IN THE NEW-BORN CHARACTERIZED BY HEMORRHAGE.

HEMORRHAGES IN THE NEW-BORN.

Causes.—Hemorrhage in early life may, as in the adult, depend upon an alteration in the condition of the blood itself or upon direct injury to the blood-vessels.

As instances of the first we have the extensive disintegration of the blood, found in syphilitic infants and after the acute fevers, such as typhus, scarlet fever, etc.

Intra-uterine infection of the fetus by micrococci may be a cause of hemorrhage.

Hemorrhages from the navel following infection are also instances of this class. Tavel and Quervian have reported a case in which death on the thirteenth day after birth followed an infection of the umbilicus occurring immediately after the child was born. Postmortem examination in this case showed hemorrhages into the connective tissue, beneath the epidermis, the mucous and serous membranes, and in the kidneys. Direct evidences proved these hemorrhages to be caused by streptococcus-infection.

In a second case death occurred from pneumonia which was the result of staphylococcus-infection, as was proved by subsequent examination. The hemorrhages had occurred into the parenchyma of all the organs examined.

Symptoms.—The symptoms in the majority of cases of hemorrhage are very obscure. Bleeding occurs from the umbilicus and mucous surfaces internally, externally, or both. Subcutaneous hemorrhages (petechiæ) are common. The infant usually ceases to nurse, and is somnolent and pale. Later, convulsions and irregular respirations develop, and the child dies. A proper study of these cases can be completed only by making a postmortem examination of all infants dying of obscure symptoms.

APOPLEXY IN THE NEW-BORN.

Synonyms.—Cerebral or Meningeal Hemorrhage; Asphyxia Rubra seu Apoplectica; Hyperæmia Cerebri Traumatica.

Definition.—Cerebral hemorrhage occurring in early life. The term is, however, often used to cover all degrees of increased cerebral blood pressure.

Causes.—The most frequent cause is pressure during birth or continued compression of the head by forceps. It may, however, follow pressure on the umbilical cord during a breech presentation or otherwise prolonged labors.

Apoplexy in the new-born is most generally the result of a venous congestion of the vessels of the pia mater or choroid plexus.

Pathology.—Following distention of the cerebral sinuses by asphyxia or other causes, or a rupture in the capillary vessels of the pia mater, the blood is effused into the subarachnoid space. As in the very young the connection between the inner covering of the brain and the cerebral tissue is not intimate, the area of hemorrhage may extend over a large surface or burst into the subdural space, compressing the brain substance—indeed, an actual laceration of the brain tissue may occur, leading to a secondary softening. Engorgement of the superficial cerebral veins may take place: as, according to Gowers, the ascending arteries pass into the ascending veins, and these empty themselves into the superior longitudinal sinus in a forward direction and consequently against the blood current.

Spencer and McNutt have concluded that while in most cases apoplexy in the new-born is seen in children delivered after difficult labors or where the forceps have been used, it sometimes occurs after short and easy labors, and one of the writers has recorded a case in which an infant born in breech presentation and by an easy labor presented the following symptoms: shortly after birth the breathing became irregular, and, later, difficulty in

swallowing, convulsions, left-sided hemiplegia, and rapid emaciation made their appearance.

The length of the child's life was twenty-two days. At the autopsy it was found that a clot covered the right hemisphere, this clot being gelatinous and firm and of a dark color. Not only the convolutions beneath it were in part destroyed, especially in the frontal and parietal regions, but also the brain tissue covering the ventricle, while the sites of the corpus striatum and optic thalamus were occupied by a reddish-brown clot mixed with softened brain substance.

The blood may be extravasated in points here and there over the entire brain, or may only occupy a part of the organ. In other cases extravasation may take place in one or perhaps two of the cavities in the same manner as in ordinary apoplexy. In the first form there is little laceration or injury to the brain substance. The cerebral tissue surrounding the hemorrhagic points sometimes preserves the normal appearance, being white and firm. Occasionally, however, it may present a reddish or yellowish appearance, being softened to a depth of a line or two. When the hemorrhage occurs into a cavity, in the same manner as in apoplexy of adults, the nerve-fibers are generally torn and separated. In these cases there is sure to be more or less compression of the surrounding brain substance. Unless the disease be of long standing, the cavity contains a dark, soft clot, bathed with serum. The brain substance in the immediate vicinity is softened.

Partial or complete asphyxia will cause intense congestion and engorgement of the cerebral vessels, being accompanied or followed by hemorrhage on or into the brain tissue in many instances, and, as a result, there will frequently be found a chronic meningo-encephalitis, a sclerosis, or an atrophy of a part of the brain, which in a certain percentage of cases may be followed by chronic paralysis or deficient mental development.

Symptoms.—The infant, which at the moment of birth may evince no particular symptoms, in a few hours becomes cyanosed. More or less projection of the eyeballs may be present and the tongue possibly be protruded. If the hemorrhage is at the base of the brain or is severe, the cardiac action and respirations become weak and irregular, and the child dies in collapse. If the effusion is small or is in the cortex, or if simple hyperemia without rupture is present, the child may recover. It should not, however, be forgotten that permanent paralysis, convulsions, or even idiocy may follow such a condition.

Davis cites a case in which an infant delivered with axis-trac-

tion forceps without difficulty displayed symptoms of progressive feebleness of respiration. Failure to nurse and apparent exhaustion caused death in thirty-six hours after birth. A postmortem examination showed the tissues of the scalp to be intensely congested, but no gross lesion, either rupture or fracture, was present. The cortex of the cerebrum was filled with punctate hemorrhages, and over the point of greatest convexity the brain substance was materially softened. Virchow and others have shown that the blood-vessels of the infant's brain are thin and small, and most readily injured by abnormal pressure.

Treatment.—The indications for treatment are mostly prophylactic, and care should be taken to prevent excessive birth pressure by prompt deliverance of the child by forceps or suitable operative procedure. There is much more danger in the continued pressure on the child's head by the maternal parts during a long labor than by a skilful forceps delivery. On the other hand, undue pressure on the fetal head by the forceps or the forcible rotation of the same should be avoided. After cerebral hemorrhage has occurred but little can be done for the patient except to keep the infant as quiet as possible and relieve symptoms as they arise.

HEMORRHAGES FROM MUCOUS SURFACES.

Causes.—Hemorrhages from various mucous membranes of new-born infants result most frequently from malnutrition and its consequent anemia or from hemophilia. They may also be caused by congestion of the pelvic organs, due to the sudden cessation of the flow of blood through the umbilical arteries.

The most common site of such hemorrhages is from the mucous membrane of the vagina in female infants, although it may occasionally occur from the rectum or mouth, and, rarely, from the nose.

Treatment.—When the hemorrhage is the result of simple congestion in a robust, hearty child, no treatment is required. When the infant is anemic, it is well to employ minute doses of arsenic, careful regulation of the nursing, and inunctions of olive or cod-liver oil, combined with soap liniment in the proportion of about three parts of the former to one part of the latter.

When the bleeding surface can be reached, applications of a solution of boric acid or a hot mixture of creolin and water, one dram to the quart, are useful.

When the hemorrhage is the result of simple congestion or anemia, the prognosis is good.

CAPUT SUCCEDANEUM.

Synonyms. — SUPPLEMENTARY HEAD; SPURIOUS CEPHALHEMATOMA; SUBAPONEUROTIC CEPHALHEMATOMA; KOPFGESCHWULST.

Definition.—A tumor upon the presenting part of the fetus, the result of serosanguineous infiltration under the skin and subcutaneous tissue, due to pressure.

The tumor occurs upon that portion of the presenting part of the child which is itself not subjected to pressure.

The size of a caput succedaneum increases generally in proportion to the length of the labor. The color of the tumor is bluish red, and there is no fluctuation or pitting on pressure.

Causes.—Continued pressure upon that portion of the fetal skull which receives the greatest impact of force during descent and rotation, temporarily checks the free circulation of the blood and lymph through the tissues of the scalp and fascia. On the opposite side of the vertex there remains a portion of the scalp which endures less pressure from the bony pelvis, and it is here that the blood and lymph of the scalp are prevented from circulating through the other side of the fetal head by pressure, and thus accumulate, distending the tissues of the side least pressed upon. Consequently, we find the tumor generally on the side opposite to that which is actually engaged in the pelvis in the first stage of labor.

The *situation* of the caput succedaneum will sometimes give a clue to the position occupied by the child in the uterus: thus, in the case of an infant occupying a position with the vertex to the right anterior half of the mother's pelvis and the fetal back to the mother's right, the caput succedaneum will be found on the left parietal portion of the child's head.

In shoulder presentation the tumor is found on the presenting shoulder.

Varieties and Pathology.—In cases in which the labor is very protracted and the head subjected to long-continued pressure, the caput succedaneum may cover *both* parietal bones, and this fact is regarded as one of the diagnostic features between it and true cephalhematoma.

Occasionally two tumors, a primary and a secondary, may be found, and in such cases the first tumor is formed in the manner previously described and the second is due to pressure after the head is rotated on the floor of the pelvis, the presenting part being detained for a considerable time in this position.

Treatment.—In the majority of cases caput succedaneum

needs no treatment. When the tumor is very large, some stimulating evaporating lotion, such as solutions of chlorid of ammonia, camphor and alcohol, or cold cream, may be applied on cotton, which should be held in place by a firm bandage. As a rule, the tumor need occasion no further solicitude.

If the tumor persists, some authorities advise either aspiration or incision, after which pressure, by means of a pad of salicylated cotton and a bandage, should be applied. If, as sometimes happens, the tumor becomes infected and an abscess forms, it should be opened under strict antiseptic precautions and treated in the usual way.

CEPHALHEMATOMA.

Synonyms.—THROMBUS NEONATORUM; ECCHYMOMA CEPHALÆMATOME.

Definition.—An elastic, nonfluctuating tumor of hemispheric form, occurring usually on the scalp and increasing in size after birth.

Causes.—The causes of cephalhematoma are obscure, and the literature of the subject contains many conflicting statements regarding its etiology.

According to Ashby and Wright, cephalhematoma is in part caused by asphyxia, during which there are increased tension in the cranial veins and an altered condition of the blood, allowing extravasations.

Pressure would seem in some cases to be a cause, as might be inferred from the situation of the tumor—namely, on the right parietal bone; but the literature of the subject contains the reports of a number of cases in which the tumor occurred upon parts which had not been subjected to pressure during birth, and one case is recorded in which the tumor was seen on the head of a child delivered after Cesarean section.

Virchow believes that the pericranium is formed by a proliferation of the inner layers of the periosteum. When separation of the latter from the bone by an extravasation of blood occurs, the bone-producing layers of the periosteum are still formed, but are prevented by the blood-clot from uniting with that portion of the bone for which they are intended; they therefore join themselves to the bone at the border of the extravasated clot where the bone is yet attached.

The cause of cephalhematoma has also been ascribed to traumatism and to alteration in the blood itself, this alteration being due to malnutrition.

Regarding the frequency of cephalhematoma, it is found more often in males than in females. It occurs about once in every 200 births.

Hennig noticed that it was situated fifty-seven times over the right parietal bone, thirty-seven times over the left, and in twenty-one cases it was found over both; in seven cases it was over the occipital bone, three times it was noticed over the frontal, and twice over the temporal (Ashby and Wright).

Cephalhematoma never extends beyond the borders of the bone upon which it is situated.

Symptoms.—The tumor usually appears on the third or fourth day after birth. In appearance it presents no discoloration of the surface and is without fluctuation. In size it varies from that of a walnut to that of a hen's egg. Usually there is no discoloration of the scalp around its borders. Little or no sensitiveness exists in the tumor.

The swelling usually remains about a week after its appear-

FIG. 12.—SECTION OF CEPHALHEMATOMA.

ance. For the first few days it continues to increase in size and then slowly diminishes.

A few days after its development a distinct and well-defined ridge will be found at its circumference, this ridge being due to deposits of bone made by the periosteum.

Examination of this ridge may give the impression that a defect exists in the bone upon which the tumor occurs, and that the tumor is protruding through a perforation in the cranium.

After the decrease and disappearance of the tumor, the bony ridge may remain for a time, but finally disappears, leaving no trace behind.

Pathology.—The usual situation of the tumor is on the right parietal bone; a number of cases, however, have been reported in which the cephalhematoma was found in other situations.

Hofmohl observed it to be bilateral in twenty-six cases, and in each of these the fontanel lay as a deep sulcus between the tumors. A classification of cephalhematoma based on its situa-

tion has been made by various authors. Ashby and Wright differentiate it as follows:

External Cephalhematoma,	1. Subaponeurotic, spurious cephalhematoma, or caput succedaneum.
	2. Subperiosteal, the true cephalhematoma.
Internal Cephalhematoma,	3. Subcranial.
Meningeal Hemorrhage,	4. Subarachnoid.

It would seem to the authors, however, not only from their own experience, but also from a review of the literature on the subject, that cephalhematoma is usually described as that form of blood tumor beneath the periosteum and external to the cranial bone—the subperiosteal of the above classification, and it is the pathology of this form which is here described. Other forms of hemorrhage within the cranium belong more properly under the classification of "intracranial hemorrhage."

Macroscopically, sections of cephalhematoma show that an extravasation of blood has taken place between the periosteum and the bone, the surface of the latter being roughened.

Some thickening, the result of inflammatory irritation, occurs around the margin of the tumor where the pericranium is attached, and it is at this point that the shell-like deposit of bone occurs.

Kirk describes the formation of these tumors as follows:

The principal bones forming the cranial vault are developed in membrane or fibrous tissue. This membrane later consists of two layers, an external fibrous and an internal cellular—osteogenetic or the true bone-forming layer. If a thick metal plate be inserted beneath the periosteum during its formation, it will soon be covered by an osseous deposit; but if placed between the fibrous and the osteogenetic layer, the plate will not be covered with bone-cells, thus showing that the osteogenetic layer is only capable of developing bone from its lower surface. When extravasation of blood takes place, as in the true form of cephalhematoma, the osteogenetic layer is pushed away from the bone, but continues its power to develop bone-cells, and this deposit is increased around the area of limitation of the tumor, —that is, the point at which the periosteum covering the tumor joins that which covers the remainder of the cranium,—thus forming the hard bony shell which surrounds the tumor.

Diagnosis. — Cephalhematoma may be differentiated from caput succedaneum, hernia of the brain, craniotabes, and cranial angiomata. From caput succedaneum it can be distinguished

by the fact that cephalhematoma bears no relation to the difficulty of the labor; on the contrary, it frequently does not appear until some days after birth. In cephalhematoma we find a fluctuating center to the tumor, but it lacks the boggy feel of caput succedaneum. There is no discoloration of the scalp in the former, as would be found in the latter. Cephalhematoma also never crosses a suture, and is surrounded by the ring of bone before mentioned.

From hernia cerebri it can be distinguished by the absence of fluctuation in protrusions of the brain. In hernia there will be pulsations which are synchronous with the child's heart-beat.

Hernia also enlarges when the child cries, and always shows itself between two bones or in the region of a fontanel.

Craniotabes can be diagnosticated by the softened patches which occur in the skulls of children affected with rickets; these lack the swelling and clearness of outline of a cephalhematoma and no fluctuation is present.

In *vascular tumors* of the scalp there is discoloration of the parts and absence of fluctuation in the center; there is no bony growth around the tumor, and the swelling bears no relation to suture or fontanel.

Prognosis.—Unless some systemic weakness is present, the prognosis is good.

Treatment.—In the largest number of cases cephalhematoma will disappear without any treatment whatsoever. In some instances where the tumor is not large, shaving the hair and painting the growth with collodion or some evaporating lotion is recommended. In regard to aspirating or opening the tumor, the opinions of authors differ: the former treatment may be followed by sepsis, and the danger of severe hemorrhage may present itself after incision of the tumor when the growth connects with an extravasation of blood inside the cranium.

HEMATOMA OF THE STERNOCLEIDOMASTOID.

The most common cause of this tumor is injury to the neck of the infant following an attempt at forcible extraction of the head in a breech presentation.

The danger of the injury is increased when the infant is partially asphyxiated, in which case the muscles lose their tone, the vessels weaken, and on this account the escape of blood is more apt to occur. The direct cause of such a blood tumor is the

laceration of a vessel and consequent hemorrhage into the sheath of the sternocleidomastoid muscle of one side.

Microscopic examination will show effusions of blood with rupture, more or less extensive, of the muscular fibers.

Jacobi considers prolonged extraction with forceps a frequent cause of this abnormality.

Symptoms.—The swelling may appear on the neck in from a few days to a week after birth, and on examination a tumor varying in size from that of a walnut to that of a hen's egg is

FIG. 13.—HEMATOMA OF THE STERNOCLEIDOMASTOID.—(*From a patient in the Philadelphia Polyclinic.*)

found in the upper part of one sternocleidomastoid muscle, the right side being the most frequent site of the hemorrhage. The outline of the mass is somewhat irregular, and if existing for some time, the growth may be cartilaginous. The duration of the tumor is from one to two months, after which time it slowly disappears.

In some cases chronic torticollis may result from such injuries. Paralysis of the arm on the injured side is occasionally seen. No especial treatment is needed in the majority of cases.

UMBILICAL HEMORRHAGE.

Causes.—Hemorrhage from the umbilicus may result from slipping of a ligature attached to the stump of the cord or by the ligature cutting through the umbilical arteries or veins. Compression of the vessels by the ligature may not be sufficient to stop oozing of blood because of excess of Wharton's jelly, or the stump of the cord may be too short to hold the ligature. Bleeding from the navel is also a symptom found frequently in children suffering from asphyxia or atelectasis, from hemophilia, acute fatty degeneration, acute hemoglobinuria, or from syphilis. Pyogenic infection of the umbilical stump is also a frequent cause of hemorrhage.

Treatment.—The prophylaxis consists of the careful tying of the cord with an aseptic ligature after it has been washed with some suitable antiseptic solution. The treatment of the stump consists of inclosing it in a mass of gauze or absorbent cotton, dusted over with one part of salicylic acid, boric acid, or acetanilid to three or four parts of starch powder.

The stump should be placed on its upper side, with its dressing held in place by a moderately firm abdominal band. When umbilical hemorrhage results from pathologic causes, such as have been previously mentioned, attempts should be made to tie the bleeding vessels by means of a silk ligature or two sterilized surgical pins, the latter being passed through the stump at right angles to each other and a ligature wrapped around the pins in the form of a figure eight. Various styptic applications may be indicated, and pressure by a cotton pad and tight binder should be made.

The **prognosis** of umbilical hemorrhage resulting from any form of constitutional disease is usually far from good.

GASTRO-INTESTINAL HEMORRHAGE.

Causes.—Hemorrhage from the stomach or intestines may arise from the passage of blood through the intestines, blood having been swallowed in nursing from a fissured nipple. Such blood is either vomited or passed through the bowels as black or brownish-black masses.

Hemorrhage into the bowel, the result of long-continued pressure during birth, may cause evacuation of similar masses in the stools.

Perforation of a blood-vessel in the duodenum through an in-

testinal ulcer is a somewhat rare cause of this form of hemorrhage.

Hemophilia may also be a cause of gastro-intestinal hemorrhage, and when originating from this source, the bleeding appears in the first day or two of life. Purpura and syphilis have also been given as causes.

Occasionally a slight bleeding from the intestine may arise without any apparent cause. Possibly this hemorrhage may be produced by a congested condition of the abdominal organs due to the change in the circulation at birth.

The **symptoms** are those of internal hemorrhage at any time of life. The child becomes restless, pale, the extremities are cold and the fontanels are sunken. The child will vomit, and with the vomited matter brownish-black masses of blood will be found.

The same characteristic masses will be found in the discharge from the bowels. The abdomen becomes dull and tumid on percussion.

Pathology.—In many cases a postmortem examination will reveal nothing but a simple congestion of the gastro-intestinal mucous membranes. In other instances ulceration of the stomach or intestines will be found.

Treatment.—The treatment should be directed toward checking the hemorrhage, when this is possible. For this purpose ergot or ergotin, the latter in doses of from ¼ to ½ of a grain, may control the bleeding. The drug may be given mixed with simple syrup or mucilage. Tannin or gallic acid in small doses in syrup of rhatany is advised by some.

Occasionally good results follow gentle irrigation of the bowels with hot water at a temperature of 110° F. (43.3° C.), the injection being given from a fountain syringe and containing a two per cent. mixture of creolin.

DISEASES CHARACTERIZED BY JAUNDICE.

ICTERUS IN THE NEW-BORN.

Synonyms.—YELLOW GROOM; INFANTILE JAUNDICE; GELBSUCHT; ICTÈRE.

Usually about the third to the fifth day of life a certain amount of yellowish discoloration of the skin appears. This first manifests itself in the face, and quickly spreads to other parts of the

body. It continues for five or six days and gradually disappears. The urine during this time assumes a saffron color, and examination will reveal an excess of bile pigment. This condition is known as physiologic jaundice. It occurs in from 60 to 80 per cent. of infants, and is rather more common in children born in hospitals than in those seen in private practice.

Causes.—The following theories have been ascribed as causes of jaundice in the new-born infant:

Following birth a rapid destruction of blood-corpuscles takes place, this producing an excess of bile pigment. The jaundice then is said to be of hematogenous origin. It is also supposed that a certain amount of blood from the portal vein, owing to a patulous condition of the ductus venosus, passes into the general circulation without being acted on by the liver. The swelling of Glisson's capsule is also given as a cause; this swelling commences at the umbilical vein and prevents the discharge of bile through the hepatic vessels. Other causes, such as alteration of the blood pressure at birth and congested condition of the skin, have been given.

Symptoms of the Simple Form.—A slight yellowish discoloration of the face appears about the third or fourth day, and in the course of a few hours the entire body assumes a yellowish tint.

Not infrequently the pigmentation may extend to a slight extent to the conjunctiva or sclerotic.

Treatment.—No especial treatment is required other than some mild laxative, such as a half teaspoonful of olive or castor oil or the following formula:

℞. Hydrarg. chlor. mite, ... gr. $\frac{1}{10}$
Pulv. ipecac., ... gr. $\frac{1}{4}$
Sodii bicarb., ... gr. ij.
SIG.—To be given every two or three hours.

MALIGNANT JAUNDICE IN THE NEW-BORN.

Under the title of morbid or malignant jaundice in the new-born infant may be described the discoloration of the skin and coexisting symptoms resulting from retention in the blood of various bile products. This retention is due to stricture, congenital or acquired, to catarrh of the gall-ducts or gall-bladder, duodenal catarrh, defective hepatic circulation, asphyxia, melena, Winckel's disease, long-continued birth pressure, syphilis, or a continued exposure to damp, cold, or impure atmosphere. Jaun-

dice is also a frequent symptom of septic infection in new-born children.

Symptoms.—In conjunction with the symptoms of any of the diseases given as causes, we find the ordinary jaundice in the new-born continuing beyond its usual period of duration. These symptoms are accompanied by increasing drowsiness, subnormal temperature, and failure to nurse. The stools are black and tar-like. Unless amelioration of the symptoms occurs, death follows on about the tenth day.

Diagnosis.—This is easily made from the color of the skin, conjunctivæ, character of the stools, and, in the malignant form, the general symptoms. Of great importance is the differentiation of the disease causing it. When the jaundice arises from acute fatty degeneration or from hemoglobinuria (Winckel's disease), the blood changes (see description of these diseases), purpuric patches in the skin, hemorrhages, or cyanosis will aid in the diagnosis.

When obstruction to the duct of the gall-bladder (hepatogenous jaundice) produces the disorder, the discoloration is intense and no bile can be found in the stools.

Treatment.—The treatment must be directed to the cause. Action of the ducts and intestine should be stimulated by small doses of calomel combined with phosphate of soda, chalk, or lime. Attention must be paid to the skin, to increase as far as possible its activity.

The infant should be kept in a warm, pure atmosphere and should be fed as much as possible on breast milk or the best artificial substitute that can be obtained.

The action of the kidneys must be increased as much as possible by small quantities of hot boiled water given regularly.

ACUTE HEMOGLOBINURIA OF THE NEW-BORN.

Synonym.—Winckel's Disease.

This disease was first described by Winckel, who reported the results of an epidemic in which twenty-three cases were affected by the disease in the Foundling Hospital in Dresden, in 1879. Chanin, in 1873, and Bigelow, in 1875, also described this affection.

Pathology and Symptoms.—The disease is characterized by a swelling of Peyer's patches and the mesenteric glands. In the cases reported by Winckel the pyramids of the kidneys were colored a blackish red with stripes of hemoglobin coloring.

The liver and other viscera were affected by fatty degeneration. "Hematogenic icterus is present, the hemoglobin being extensively changed into bilirubin. The urine is reddish brown in color and contains epithelial casts, hemoglobin, and micrococci." It is passed in small quantities and after much straining. The first symptom noticed is a bluish tint of the face, body, and limbs —cyanosis. A little later there usually appears some yellowish discoloration of the skin of the entire body. These symptoms begin about the fourth day and progress rapidly. Diarrhea and vomiting soon make their appearance, and in a short time the child refuses to nurse. The duration of the disease is usually about two days, the child dying in convulsions or collapse. The mortality in Winckel's cases was nineteen out of twenty-three.

ACUTE FATTY DEGENERATION IN THE NEW-BORN.

Synonym.—BUHL'S DISEASE.

The **cause** is obscure, although in some instances the origin has been ascribed to a condition of lowered vitality in the mother during pregnancy. Apparently the disease begins in the latter portion of gestation. Asphyxia has been given by some as a probable cause and by others as a result of the disease.

Pathology.—The pathologic changes seem to consist of a general parenchymatous inflammation of all the organs. Small hemorrhagic patches are found in the various viscera, and some of these organs are found infiltrated with blood and bile. Microscopic examination of the tissues of the various internal organs, and particularly of the liver, kidneys, and heart, will show a state of acute fatty degeneration.

Symptoms.—The disease usually appears in from the first to the sixth day of life, the child becoming jaundiced or pale. Hemorrhages occur from the intestines or umbilicus. Petechial patches will be found under the skin and mucous membranes, particularly that of the mouth. Actual hemorrhages may also take place from the various mucous surfaces. There is more or less cyanosis, and actual asphyxia may be produced by fat emboli being washed into the pulmonary circulation. Dropsy, general or local, will be seen in many cases.

The **treatment** consists of stimulating the patient as much as possible and checking the hemorrhage; for the latter purpose ergot or tannic acid in suitable doses is to be given. In the majority of cases the child dies notwithstanding all our efforts in its behalf.

DISEASES PRODUCED BY SEPTIC INFECTION.

GENERAL SEPTIC INFECTION OF THE NEW-BORN.

Septic infection in the new-born may arise either from antepartum or postpartum causes. The most frequent causative factor is the entrance of infective micro-organisms through the granulating surface left by the stump of the umbilical cord after the latter has fallen off. From this origin an inflammation of the arteries and veins results, and subsequently thrombi and infiltration of the surrounding tissues follow. The infection usually travels along the course of the umbilical arteries within the abdomen, and later frequently involves the bladder and tissues immediately surrounding it. During the progress of the infection within the body the umbilical scar may remain open, or, as is not uncommonly found, may close and heal, there being nothing left but a small ring of inflammation surrounding it. Weber and Runge have pointed out that in those cases in which infection has occurred through the umbilicus the tissue around the artery is first involved after the infection has traveled within the abdomen. The iliac vessels and retroperitoneal connective tissue are usually not attacked.

As a result of general septic infection peritonitis and metastatic abscesses may appear in the abdominal viscera, or the joints may become involved and arthritis follow. In two-fifths of the reported cases Runge observed pneumonia or pleurisy followed by small metastatic abscesses.

When the case has a fatal termination, death usually results from pneumonia or pleurisy, although pericarditis is not an uncommon cause.

Symptoms.—In antepartum sepis, in those cases in which the child is born alive, death usually occurs in a few days from interstitial pneumonia or fatty degeneration. When the child dies before birth, the skin will be found macerated and effusions of bloody serum occur in various cavities of the body. Patches of ecchymosis will be seen in the peritoneum, pericardium, and pleura.

The symptoms of postpartum infection usually begin with a ring of inflammation around the umbilicus; this is often followed by ulceration (omphalitis). In quite a number of cases this inflammation may subside and the umbilical scar will appear to be partially or completely healed. The infant will, however, have a fever ranging from 101° F. to 103° F. Anorexia appears

and the child refuses to nurse. The usual jaundice following birth, instead of disappearing on the third or fourth day, will continue to increase, the stools remaining dark and tar-like. Some distention of the abdomen, with general symptoms of peritonitis, soon manifest themselves, the child holding its legs and thighs constantly flexed. The breathing is thoracic in character and is rapid. In some cases ulceration of the mouth, pharynx, intestines, bones, or joints may be observed. Emaciation is rapid and progressive; vomiting and diarrhea sometimes appear. The inflammation of the larynx may result occasionally in actual croup (septic croup).

When death occurs, the immediate cause is usually convulsions or exhaustion, pleurisy, or pneumonia.

The **prognosis** in septic infection of the new-born is distinctly bad.

Treatment.—The best preventive treatment of septic infection in the new-born lies in the careful attention to the umbilicus from the moment of section of the umbilical cord until the time that it has fallen off and the wound is completely healed. It should be remembered that the site of the umbilical cord is always an absorbing surface, through which septic micro-organisms may gain entrance to the child's body, and therefore as much care should be directed to the antiseptic dressing of the cord-stump as would be exercised in dressing any other wound. During the process of mummification of the cord-stump it should be kept covered with some drying antiseptic powder. It is of great importance that the cord-stump should be kept dry. When a drop or two of pus appears in the umbilicus after separation of the cord-stump, the folds of the umbilical scar should be carefully mopped out with a saturated solution of boric acid or hydrogen peroxid, applied on a small piece of cotton.

The superiority of the latter antiseptic lies in the readiness with which it passes between all the folds and crevices of the umbilicus and removes all foci of infection.

Intra-uterine infection should be guarded against as far as possible by careful attention to the mother's health during gestation. Various constitutional diseases, such as syphilis or gonorrhea, should be suitably treated, and all sources of infection from irritating vaginal discharges should be removed by the use of antiseptic douches and cleansing the external genitals during the last week of pregnancy. The constitutional treatment of an infant suffering from septic fever is the same as the treatment of sepsis in the adult, remembering, of course, the age of the patient. The high temperature should be reduced by cool

sponging and possibly some alcohol, the latter in doses suitable for the age and condition of the child. Minute doses of strychnin and quinin are also of use.

OMPHALITIS.

Definition.—An inflammation of the navel itself or of the surrounding parts.

Cause.—In the majority of cases omphalitis is of septic origin, although occasionally its cause may be doubtful. Syphilis is a frequent cause. It may confine itself to the umbilicus and immediately surrounding tissues, or may spread and involve nearly the whole of the abdominal wall, either superficially or throughout its entire thickness. The disease begins in the second or third week after birth and may continue for some time. Unless the inflammation extends to the peritoneum, the prognosis is fairly good. In some perfectly normal infants separation of the cord is followed by a slight irritation; this is particularly the case where undue friction or any form of local irritant has been applied. This condition is known as *excoriation* of the navel.

Occasionally after detachment of the cord a serous discharge is noticed; this may exist for some time and is known as *blennorrhagia.* The site of the umbilicus may also be affected by a *croupous* or *diphtheric* exudate.

The **treatment** of all these forms of inflammation of the umbilicus consists of absolute cleanliness and attention to the rules for prevention before mentioned. When abscesses form, they should be opened and treated antiseptically.

TETANUS IN THE NEW-BORN.

Cause.—Tetanus in early life, like the disease in adults, is produced by infection with the tetanus bacillus. The usual site of entrance is the umbilicus before the scar is completely healed. Soiled dressings or general uncleanliness are the means of transmission. The disease usually appears about the ninth day of life; hence the name "nine-day fits" has occasionally been applied to the disease. It may not, however, appear until the fifteenth day, which has been described by West as the limit at which we usually see the disease. Cases have been reported as early as the third day.

Tetanus in infancy may occur in any part of the world, the largest number of cases being found in warm climates. It may arise sporadically or in epidemics; thus we have reports of the

serious epidemics occurring in the island of St. Kilda,* and of that occurring in the island of Heimacy, off the coast of Iceland, which took place early in the present century.† It seems probable that, as the knowledge of the use of antisepsis, especially as applied to the dressing of the cord-stump in new-born infants, is understood and practised throughout the world, these epidemics of tetanus neonatorum will decrease or almost disappear. The value of the antiseptic dressing of the umbilicus was clearly demonstrated in the epidemic occurring on the island of St. Kilda, where the mortality of cases occurring previous to the introduction of asepsis was 100 per cent.; the number of cases affected decreased after its introduction to *nil.*

Symptoms.—The first phenomenon noticed is inability to nurse because of spasms of the muscles of the jaw and face generally; this is known as *trismus.* The facial spasm is soon followed by a similar condition arising all over the body, the attacks increasing rapidly in severity and length of continuance. The face has the peculiar expression described under the name of "risus sardonicus." There is also frequently associated with the disease a peculiar whining cry. The climax of the malady is generally reached in twelve hours, and when the child dies, it is in spasms or coma. The convulsions, like those of tetanus in the adult, are increased by cold or by noises. The entire course of the disease is usually about two days.

The prophylactic treatment consists of observing the rules before mentioned in dressing the cord. For the treatment of the convulsions hydrate of chloral, chloroform, and alcoholic stimulants give the best results. Opium, cannabis indica, belladonna, and bromid of potassium have been recommended. Warm baths and ice applied to the spine have occasionally been of use. The prognosis is exceedingly grave.

INSPIRATION PNEUMONIA.

This disease is usually caused by inspiratory efforts on the part of the child, due to pressure on the umbilical cord during a prolonged labor. It is most commonly found in those cases in which the vaginal secretions of the mother have been rendered septic by a preexisting gonorrhea or endometritis.

The type of pneumonia is usually lobular, and is very dangerous to life. The treatment should be prophylactic, care being taken

---

* Turner, "Glasgow Med. Jour.," 1895, No. 3, p. 161.

† Snowman, "Brit. Med. Jour.," 1895, vol. II, p. 132.

that the vaginal secretion in the mother is rendered aseptic by douches. It must be remembered in the treatment of this disease that the condition is of septic origin, and therefore the principal indications are to sustain the patient by the use of tonics, alcohol, etc. Locally, the lung conditions should be treated as any other form of pneumonia.

SCLEREMA.

Definition.—By the term sclerema we understand a hardening of the skin and subcutaneous cellular tissue and fat. The condition is accompanied by a lowering of bodily temperature.

Causes.—Sclerema may be congenital or acquired; in the latter case it is most frequent in feeble children—those prematurely born or who are syphilitic. It frequently follows exhausting diseases, such as various forms of diarrhea. The disease is most commonly found in hospitals and foundling asylums, particularly where many children are crowded together. It is more common in Europe than in America. The principal cause would appear to be extreme feebleness with continued lowering of the temperature, and, in consequence, a hardening of the subcutaneous fat. Atelectasis is frequently an accompanying condition.

Symptoms.—The first symptom noticed is the hardening of the skin, which usually begins in the lower extremities and spreads upward, affecting, in the order given, the trunk, the upper extremities, and the face. It is especially marked in the thighs, buttocks, back, and cheeks. The hardening may be universal or affect only circumscribed areas. The skin may be smooth or lobulated. The skin changes to a dirty yellow or bluish-yellow color, is hard, does not pit on pressure, and seems to be closely attached to the subcutaneous tissue. The surface of the body and even the mucous membrane of the mouth feel cold and stone-like. The bodily temperature is much reduced, falling often to 92° to 96° F. (33.3° to 38.6° C.). The respiration is slow and embarrassed. Circulation is poor.

Pathology.—The pathologic changes are in many cases obscure. In a case reported by J. W. Ballantyne there was found, on microscopic examination, to be an increase in the number and size of the connective-tissue bundles and an atrophy of the adipose tissue. Northrup reports a typical case in which no abnormal changes were found in the skin. Langer and others believe that solidification of the fatty tissues, in consequence of the very low temperature, is the cause of the hardening of the

skin. It has also been suggested that in some cases the causes are very much the same as those producing myxedema. In many of these patients a postmortem examination will reveal an edema of the subcutaneous tissues, the secretion frequently being changed into jelly-like masses. Serous effusions into the pleura sometimes occur.

Diagnosis.—The only condition with which sclerema is likely to be confounded is that of general edema, from which it may be differentiated by the fact that in sclerema there is no pitting of the skin on pressure, by the rigid condition of the body, and by the great reduction in temperature.

Prognosis.—The prognosis is bad in nearly every case, the disease generally ending fatally in from one to four days.

Treatment.—The treatment consists of improving, as much as possible, the hygienic surroundings of the child, giving massage, galvanism, and also alcoholic stimulants in moderate doses. Such drugs as strychnin, camphor, musk, malt, and general tonics have been recommended. The administration of lanolin internally has been recommended. Thyroid extract has been said to be of service. When possible, the infant should be fed by a wet-nurse, or, if it can not suck, the milk must be peptonized and given by the rectum, or the child may be fed by a medicine dropper inserted far back in the mouth. The bodily heat is to be maintained by keeping the child in an incubator at a fairly high temperature.

MELENA IN THE NEW-BORN.

Definition.—A malignant form of hemorrhage from the stomach or intestines, occurring in the new-born.

Causes.—The hemorrhage may be due to a gastric or enteric ulcer; to thrombosis resulting from embolism in the vessels of these organs. Congenital weakness of the vessels of the stomach or duodenum and persistence of the ductus arteriosus have been ascribed as causes.

Symptoms.—The symptoms are vomiting of blood or its passage in the stools. This condition is accompanied by rapid loss of flesh, failure to nurse, and continued hemorrhage, until the child dies of collapse. The attack usually lasts from one day to a week. While the prognosis is grave, cases occasionally recover.

Treatment.—The treatment consists of the use of warm antiseptic rectal irrigations, and the administration, by the mouth, of ergot or some astringent remedy.

MASTITIS IN THE NEW-BORN.

It is a common occurrence to notice a secretion of milk in the breasts of the new-born infant. This secretion is equally frequent in males and females. The quantity of milk secreted varies from a few drops to probably a dram or more in exceptional cases. The milk secreted resembles colostrum, and by analysis has been shown to be composed of fat, sugar, proteids, salts, and water. It is often termed "witch's milk." The occurrence of this secretion is of very little importance, and usually ceases after ten or fifteen days, the secretion being most active from the eighth to the fifteenth day. The breasts show all the phenomena of physiologically active organs. Should the secretion be abundant, it can usually be dried up by painting the breasts with the tincture of belladonna. Strictly antiseptic washes with compresses may answer the same purpose. Undue pressure or slight trauma from careless or rough handling may cause the breasts to become inflamed, and thus set up a mastitis which may be more or less severe and even terminate in an abscess.

Mastitis is a rare condition in infants, but it is occasionally seen and may lead to fatal results. The predisposing cause is the congestion which accompanies the active organ. The exciting cause is a trauma, micro-organisms gaining entrance to the breasts through abrasions or fissures produced by the trauma, or even, according to some authorities, through the milk-ducts. The affection is often due to a want of cleanliness. The symptoms are the usual ones seen in inflammation of the breasts. Should the condition progress to suppuration, extensive sloughing may take place, as shown in a case reported by Bush, although a single abscess is the more frequent result. The child is restless, there is a steady loss of weight, due to the fact that the child refuses to nurse, is peevish, fretful, and suffers from insomnia. The parts should be kept clean and no one allowed to press the breasts. A small cotton compress may be used for their protection.

In case acute inflammation develops, it should be treated as any inflammatory process. Hot antiseptic fomentations may be used in the beginning; should pus form, incise and drain. Keep up the child's strength with general stimulants and tonics.

OBSTETRIC PARALYSIS.

Definition.—A form of paralysis of the central or peripheral nerves occurring in the new-born and usually following prolonged efforts at forceps or manual extraction, or from other injuries to the head or extremities during birth.

Causes.—The most frequent cause is attempts at using the forceps as a means of compression or forcible rotation to the fetal head instead of using the instrument as a tractor only. Occasionally, after delivery of the shoulder in a presentation by the breech or vertex, prolonged traction made by hooking the fingers in the axillæ will result in injury to the brachial plexus. One or more nerve-trunks may suffer traumatism, and from this will arise a form of paralysis of the arm known as Duchenne's paralysis. A very common form of peripheral paralysis is that known as "Erb's paralysis," or "the upper-arm type of paralysis." This arises from injury to the fifth and sixth cervical nerves. The muscles affected are the trapezius and, to a greater extent, the deltoid, biceps, brachialis anticus, supinator longus, or the supraspinatus or infraspinatus. Any or all of these muscles may be involved.

In a number of cases the violent separation of the head from the shoulders and the consequent stretching of the plexus at the junction of the fifth and sixth roots of the brachial plexus may be a cause, as has been pointed out by Walton, Carter, and others. The first-named author gives as his opinion that in most of these cases the plexus is, during labor, already brought against the clavicle, rotation of the head away from the affected side takes place, and at the same time the suprascapular nerve is put on the stretch between the point of its emergence and the bony edge around which it passes to reach the infraspinous fossa. As the head separates from the shoulders after rotation has occurred, the shoulder being firmly held at the brim of the pelvis, its suprascapular nerve is stretched still further and the plexus bruised against the clavicle. As additional evidence in favor of his view the author calls attention to the fact that the right arm is generally affected in left occipito-anterior and right occipitoposterior positions and presentations, while paralysis of the left arm is most generally seen in those cases where the position and presentation have been right occipito-anterior.

When facial paralysis occurs, it is usually due to pressure by the forceps upon the seventh nerve at its point of exit from the stylomastoid foramen. This form of paralysis, although occasionally permanent, usually disappears in from a few days to a

week or two after birth. A much graver and more lasting form of paralysis is apt to occur from injury to the brachial plexus in the manner before described. The pressure upon the cords of this plexus may either occur in the axillæ, or, as Ross has demonstrated, the fifth cranial nerve may be easily injured by a grip of the blade upon the upper arm and clavicle at a point where the nerve descends over the transverse processes of the fifth and sixth cervical vertebræ. Lane has also reported a case of injury to the brachial plexus by forceps—the face and arm were paralyzed. On postmortem examination a clot of blood was found at the stylomastoid foramen and around the cords of the brachial plexus.

Paralysis of central origin following labor may arise from pressure by blood-clot; thus, Lihotzky has reported cases in which pressure arose from this cause, probably induced by fracture of the orbital ridge by forceps. Hirst has reported a case of laceration of one of the sinuses of the dura mater caused by the overlapping of the parietal bones during labor. Precipitate labor, following which the child has fallen to the ground, has been given as a cause of paralysis in the new-born. Instances of cerebral atrophy with hemiplegia, either alone or associated with sensory and mental debility, and accompanied by frequent epileptiform convulsions, due in many cases to birth lesions, are reported by Allen Starr and others; other instances of the late effects of forceps compression have been reported by Osler, who, in the records of the Philadelphia Infirmary for Nervous Diseases, found nine cases following instrumental delivery. Six of these had histories of direct injury by forceps, and some of them had marks on the head existing since birth. In all of these cases the paralysis appeared gradually a short time after birth.

Symptoms.—When paralysis of the arm or leg is present, there will be deficiency or absence of motion in the parts affected, and in a short time the muscles will appear soft and flabby, unless for a time masked by the abundant superficial fat. More or less complete anesthesia will be noticed. If the paralysis is of a mild type, recovery generally sets in early and may be complete. If severe, and the case remains in about the same condition for a long time, the chances for recovery are less favorable. As the peripheral nerves are not developed until several weeks after birth, any injury to them prevents their ever attaining functional competence. The response to electric tests varies with the degree and nature of the lesion; if it can not be excited or if the reaction shows the anodal closure contraction to be greater than the cathodal contraction, then there is little hope. While

the paralysis is usually confined to one nerve or one limb, it may be bilateral when the injury extends to both sides. If the face is involved, the first symptom generally noticed is a lack of movement of the facial muscles of one side; in some cases one eye may be injured, and drooping of the eyelid, contraction of the pupil, or retraction of the eyeball will be present; lack of expression on the injured side of the face and irregularity of the mouth will complete the picture.

Diagnosis.—Although paralysis due to causes incident to birth is generally easily diagnosticated, yet occasionally, from a medicolegal aspect, as well as that of the possible outcome of the case, it becomes necessary to consider certain points of differentiation. In cases of severe injury following the use of forceps, especially when compression has been used, a depressed spoon- or funnel-shaped mark will commonly be found on the areas of the fetal skull which have been within the grasp of the forceps. Occasionally these will be bounded by a well-defined ridge. The most common sites for these marks are the orbital and parietal regions and at the parieto-occipital junction. As a point of differentiation from the above, Fritsch has described the characteristic injury of the head received in falling after precipitate birth as follows: "The fracture begins in a suture and extends outward to the middle of the bone. Usually there is but one fissure, which ends where the bone is thickest. The parietal bone is the one most often injured, and the fissure usually ends in the parietal eminence." When the brachial plexus is injured, the paralysis affects but one arm, and will generally appear very soon after birth; usually while washing the child the nurse will observe that it moves but one arm, while the other hangs uselessly by its side. On examination, no evidences of a fracture of the bone will be found, and passive movement of the arm causes little or no pain. The paralysis is not generally followed by contraction. Electricity will frequently be found to be of use in determining the injury: when the nerve is but slightly injured, there will be more or less response to the faradic current; but if the injury be great, there will be little or no response.

Prognosis.—The prognosis of facial palsy of simple form, and not the result of intracranial hemorrhage or fracture, is good. The muscles usually assume their activity at the end of a few weeks. When traumatism has occurred to the large nerve-trunks or laceration has resulted, or when the nerves have been injured to a large extent, the paralysis will be slow in disappearing and permanent injury may result.

Treatment.—The treatment of injuries of the nerves of the new-born may be divided into prophylactic and curative.

The prophylaxis requires the careful study of every case of delivery. By the accurate use of abdominal palpation and auscultation the position of the child in utero must be made out and the relative size of the fetus to the birth canal through which it must pass should be determined.

While the judicious use of the forceps to aid the expulsive forces of the uterus is fully justifiable, yet long-continued traction or the high application of the forceps without axis traction can not be too strongly condemned. It is utterly useless and very dangerous to both mother and child to attempt to drag a fetus through a birth canal which is too small for it, and efforts to do this will be followed by nothing but disaster.

When, after a carefully made diagnosis, including the measurement of at least the conjugate of the pelvic inlet, it is found that the child is too large to pass, or, inversely, that the mother's parts are too small, operative procedures must be resorted to—either the Cesarean operation or symphysiotomy, and for the choice of these the student is referred to the text-books on obstetrics.

In cases where an infant is born with symptoms of cerebral compression following forceps delivery, the treatment by surgical means may be considered and the depressed bone elevated.

When injury to the brachial plexus has occurred, the treatment should consist of rest for the injured arm and, later, passive exercise. When the arm itself is injured, it should be wrapped in cotton batting and fixed to the side, care being taken that in bathing or dressing the child the arm is not allowed to hang down, as by so doing the injuries to the nerves may be increased. Tight bandages must be avoided. At the end of four or five weeks the muscles may be treated by massage, shampooing, and galvanism.

As the progress of these cases is at best very slow, treatment must not be discontinued so long as any improvement, no matter how slight, continues. Massage and electricity do much good in these cases.

UMBILICAL POLYPI.

Polypoid granulations around the umbilicus occasionally appear and cause an oozing of blood. The treatment should consist of cleanliness and the application of some antiseptic, such as peroxid of hydrogen in a spray and solutions of silver nitrate.

The **prognosis** is generally favorable.

DIVERTICULUM TUMOR AND PERSISTENCE OF THE OMPHALOMESENTERIC DUCT.

Owing to the imperfect obliteration of the vitelline or omphalomesenteric duct during fetal life there may arise a number of abnormalities, among which are Meckel's diverticulum and a patulous condition of the omphalomesenteric duct. The former

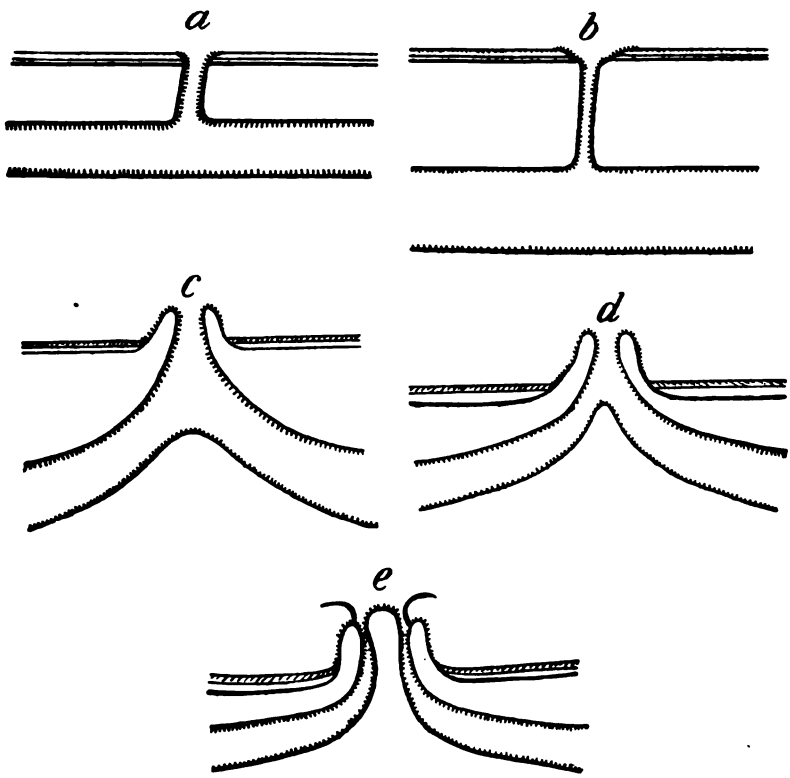


FIG 14.—DIAGRAM ILLUSTRATING THE EFFECTS OF THE PERSISTENCE OF THE OMPHALOMESENTERIC DUCT AND THE FORMATION OF THE SO-CALLED DIVERTICULUM TUMOR. —(*Riesman.*)

appears as a blind pouch on the convex surface of the lower part of the ileum, and may occasionally extend to the umbilicus. The omphalomesenteric duct exists as an open cylindric tube leading from the umbilicus to the ileum. (See *a*, *b*, Fig. 14.) Both the diverticulum and the duct are lined with mucous membrane similar to that of the ileum. When the diverticulum or duct connects with the umbilical opening, the mucous membrane of

the duct becomes continuous with the skin at the navel and consequently there is noticed soon after the dropping of the umbilical cord a small reddish excrescence from which may escape mucus, occasionally bile-stained, and in some cases a small amount of fecal matter. Not infrequently the mucous membrane of the duct or diverticulum, and, indeed, in some cases the entire organ, may become prolapsed through the umbilicus, forming a tumor (see *c*, Fig. 14) which is known as a mucous polypus or diverticulum tumor. The tumor is usually small, about the size of a cherry or pea, and cylindric in shape and not pedunculated. It is covered with mucous membrane, and has at its most prominent part a small opening or fistula. By means of a probe or catheter this opening can be traced to the intestine. During straining at stool or paroxysms of coughing the entire duct may prolapse through the umbilicus, and with it a portion of the proximal intestinal wall (see *d*, Fig. 14) or a small complete loop of intestine. (*e*, Fig. 14.) In these cases the tumor is larger, often the size of a man's fist, irreducible, is sausage-shaped and often bicornate. The covering of the tumor is the mucous membrane of the intestine. When a portion of the intestinal wall prolapses, there is but one external opening or fistula which bifurcates a short distance from the surface, one portion going upward and the other downward. In case a complete section of the intestine has prolapsed, two openings can be seen, one opening passing into the upper and one into the lower segment of the bowel.

Prognosis.—When the tumor is composed only of the diverticulum and not accompanied by serious prolapse, the prognosis is good. Prolapse of the duct alone is always serious, and when accompanied by the bowel, the result is usually fatal (Riesman). One of the dangers of the condition arises from the fact that these tumors are often mistaken for other growths, and operative procedures are attempted which are followed by disaster. Strangulation of the bowel, caused by the diverticulum or duct, may also occur.

UMBILICAL HERNIA.

Hernia through the umbilical ring arises from imperfect closure of the parts. The congenital form may be the result of the non-closure of the ventral lamina, or it may be due to the continuance of the fetal condition, in which a coil of intestines remains outside the abdominal cavity, the result of imperfect closure of the anterior walls of the latter. In other words, there is an arrest of development of the abdominal walls, while one or more coils of intestines, which, during embryonic life are developed outside the

abdominal cavity, fail, by the deficient development of the latter, to be inclosed in the usual way. Climate seems to have some effect as a cause of umbilical hernia; thus, according to Wert, Spain and Portugal have the highest percentage of cases of hernia in proportion to the population, and South America the lowest. In the United States, Minnesota has the highest average and West Virginia the lowest. Umbilical hernia may be congenital or acquired. In the congenital form the most frequent cause is the arrest of development of the abdominal walls, as before described. Another cause of this variety of hernia is probably the failure of the normal process of atrophy of the umbilical vesicle. The acquired form is much more generally seen in badly nourished, poorly developed children, or in those who have been weakened or debilitated by disease. It is not infrequently seen in children with chronic diarrhea or in the same class of children who, from any reason, have violent attacks of vomiting or coughing. An elongated uvula may act as a secondary cause of hernia by producing violent efforts at vomiting or coughing. Rectal polypus and chronic diarrhea have also been given as causes. No matter from what source the hernia arises, it will appear as a soft tumor in the center of the umbilical ring. This tumor will be increased by the act of coughing or efforts of bearing down. The site of the protrusion, while usually occurring in the position named, occasionally appears above the ring between the recti muscles. In this latter instance it is more properly called ventral hernia.

Treatment.—In early life a complete cure can often be effected by drawing the two sides of the ring together after replacing the hernia, and passing bands of rubber adhesive plaster about the abdomen so as to keep the ring closed. The strips should be about ½ of an inch wide. This dressing must be repeated from time to time until the intestine ceases to protrude. Care must be taken, however, that the delicate skin is not chafed by the adhesive plaster. To prevent this the skin may be dusted with some mild aseptic powder before dressing.

The ordinary treatment consists of covering a convex button with cotton or buckskin and making pressure against the ring with the convex side of the button, the latter being held in place by a bandage around the abdomen.

Operative treatment is sometimes useful. When the umbilical ring remains open and surgical means can not be tried, the hernia must be replaced and the opening closed by a suitable truss. This truss usually consists of a convex rubber button held in place by a spring or a rubber bandage.

CHAPTER III.

GENERAL HYGIENE OF INFANTS AND CHILDREN.

As soon as the child is born it should be laid on its side upon the bed, far enough away from the mother to prevent her rolling upon it. The first attention after severance of the cord should be directed to the breathing, care being taken that inspiration and expiration are regular. Any accumulation of mucus in the mouth should be removed by a finger covered with soft muslin or lint soaked in a solution of boric acid. Should the respiration be weak, the child should be held head downward and a small stream of cold water poured on the chest. Slapping the buttocks or chest with a towel wrung out in cold water will often aid in the establishment of respiration. When asphyxiation occurs, it should be treated according to methods previously described. Care must be taken to see that no bleeding occurs from the umbilical stump, and that the ligature is fastened securely. The material used for the ligature must be sufficiently strong to hold without slipping, and at the same time not be so thin as to cut through the jelly of Wharton or possibly the umbilical vessels. Frequently if slipping of a ligature does occur in from twelve to twenty-four hours after birth, the vessels are sufficiently contracted to prevent hemorrhage; indeed, we have observed in at least two cases in which the ligature has slipped but a few hours after birth that the hemorrhage has proved very slight. The material used in tying the cord should be a double strand of linen thread or a single strand of "G" linen fishing-line. A stout ligature of twisted silk will do very well. The ligatures in all cases must be rendered aseptic before applying.

The eyes of the new-born infant are one of the most important objects for attention. As soon as respiration is established and the cord tied, the eyes should be carefully washed with a solution of boric acid; in many cases this is sufficient. However, it is generally recommended that a drop or two of a solution of five grains of nitrate of silver to the ounce of distilled water be dropped in the eyes from a medicine dropper. This may again be advantageously followed by carefully mopping the eyes with sterilized water after any excess of silver nitrate has been neutralized by instilling a few drops of a 10 per cent. solution of sodium

chlorid. When the mother has had a purulent vaginal discharge, it is often necessary to instil into each eye a few drops of a 1 : 12,000 solution of bichlorid of mercury, followed by a similar application of distilled water. Before giving the infant its first bath it is necessary, on account of the sticky, cheese-like secretion which covers the skin (vernix caseosa), to smear the child's body with either olive oil or vaselin. Unless this is done, the vernix caseosa is extremely difficult to remove. The first bath should be given in a room the temperature of which is from 65° to 70° F. (18.3° to 21.1° C.); the temperature of the water should not exceed 96° F. (35.6° C.), as the skin of the new-born is extremely sensitive, and a too hot bath may cause irritation thereof, which may amount to an actual dermatitis. Soap may be used in this bath, providing it is free from strong alkalies, the best soap being a superior grade of Castile, or, as some recommend, Unna's "overfatty" soap. After bathing, the skin should be mopped dry with a soft towel, after which it should be dusted with a powder consisting of 2 per cent. of salicylic acid and finely powdered starch, or boric acid or thymol, 5 per cent. in starch powder. Some prefer to use the oil alone, wiping this carefully off after applying, and to use no water for several days or weeks.

The infant should be dressed in a soft, unstarched material, made loose, so as to prevent pressure and allow perfect freedom of motion. It is well to avoid all excessive ornamentation with lace. The diapers should be made of soft absorbent material, and a sufficient number provided to allow of change and washing after each evacuation of the bowels and bladder.

The cord-stump should be dusted with any of the antiseptic powders before referred to, and may be laid so that the severed portion points upward, and covered with a little bag of gauze or a small pad of absorbent cotton, held in place by an abdominal binder of light flannel, care being taken that this bandage is loose enough not to interfere with respiration.

As soon as the child is washed and dressed it should be laid in a small crib by itself. It should never be allowed to sleep in the same bed with the mother, as there is danger of her rolling over on it during sleep and causing suffocation.

Shortly after the child is washed and dressed it should receive a teaspoonful or two of hot sterilized water; this acts on the kidneys, aiding in the establishment of urination and stimulating renal action generally. It is well to put the child to the breast from two to four hours after birth, or as soon as the mother is adequately rested.

From birth to the end of the sixth or eighth month the infant should sleep from 11 P.M. until 5 A.M., and as many hours during the day as nature demands and the times of feeding, washing, and dressing will permit. From the eighth month to the end of two and a half years the child should sleep from noon until 1.30 or 2 P.M., and at the time of taking this nap it is to be undressed and put to bed. At 7 P.M. it should be put to bed for the night. When the child reaches the age of from two and a half to four years, the morning nap may occasionally be omitted, according to indications, but in all cases the time for the night's rest properly begins at 7.30 P.M., and should last until 6 or 7 A.M. After the fourth year the daytime nap need not be insisted upon, but the child should be put to bed by 8 P.M., and sleep for at least ten hours. When possible, the sleeping-room and the room occupied in the day ought not to be the same; or, when this is not feasible, the child should be removed to some other room for an hour or two before retiring for the night and the sleeping-room well aired. The temperature of the sleeping-room should be from 64° to 68° F. (17.8° to 20° C.), and this temperature is to be maintained as uniformly as possible.

The Bath.—The child should be bathed at a regular time each day, one bath in the twenty-four hours being considered enough. This should be given during the morning, at a time about halfway between the first two feedings. The temperature of the room should then be about 96° F. (35.6° C.), and kept free from drafts. The first step in bathing should be to wet the child's head thoroughly in order to prevent its taking cold. The duration of the bath should be from three to five minutes, after which the skin must be well dried and rubbed with a moderately coarse towel. After the bath the body should be covered with a blanket or flannel night-robe, and the infant put to sleep again for a short time. It is strongly recommended that occasionally in hot weather an additional sponge-bath of water at a temperature of 90° F. (32.2° C.) be given, which will have a cooling effect upon the skin. In older children cool baths at a temperature of from 72° to 76° F. (22.2° to 24.4° C.) are sometimes more valuable than warm ones. Very cold baths, except in rare conditions, are not to be recommended for children. They are, however, occasionally useful as a tonic or stimulant, increasing the excretive powers of the skin and giving tone to the body. These baths must always be given in a warm room, the child standing in enough hot water to cover the feet. The cold water should be applied by means of a sponge, one sponging of the whole body being sufficient. The temperature of the water used ought not

to be below 64° F. (17.8° C.). In many cases the addition of an ounce or two of sea-salt or ordinary rock-salt will increase the good effects of the bath, which should be followed by a thorough rubbing with the hands and a coarse towel. Another method of giving a cold bath is to allow the child to stand in hot water while the body is enveloped in a sheet wrung out of water at a temperature of 60° F. (15.6° C.), and the entire surface of the body well rubbed through the sheet, after which the child is rubbed with a towel until the skin is thoroughly dry. This method is applicable to older children.

A bath at a temperature of 94° to 100° F. (34.4° to 37.8° C.) is frequently used to produce diaphoresis, to relieve nervous irritability, and to promote sleep. When considerable stimulation is required, mustard may be added to the water in quantities from a teaspoonful to a tablespoonful. As a general rule, five minutes is long enough for immersion in a hot bath.

Exercise.—Muscular exercise in some form is necessary to the maintenance of health. Nature provides this in young infants in the frequent motion of the whole body, so that all that is necessary is to undress a young baby and let it lie on its back and kick and move at will. As the child begins to creep, and later to walk, the muscles of locomotion and of coordinated action are slowly developed.

A baby may be taken out-of-doors in from three weeks to a month after birth, and from that time on it should be kept in the open air for a certain part of every day, providing the weather permits. Moderately cold weather, if the air is dry and there is no wind, need not keep any but a very young infant indoors; the child, however, should be well wrapped up. In hot weather the head should be protected, and the child should, of course, be kept away from the direct rays of the sun. Exercise in older children is best managed in the moderate use of the ordinary games, especially those which take the child out-of-doors. Games not only help to develop the muscular system, but also give the child an object to obtain in mastering them; besides this, the obedience taught by the rules of games affords a certain discipline which acts for their good. In stormy weather children may be warmly clad and allowed to run about and play in a room with the windows open. As a rule, it is best not to allow a child out-of-doors at night.

Care of the Mouth.—The mouth of the newly born infant should be gently cleansed every day with boiled water and a soft cloth. The hands of the mother or nurse should be clean before attempting to wash the mouth of the infant. Too frequent

or any but the most gentle methods of doing this are to be discouraged, as the epithelium of the mouth of the infant is very delicate and much harm may be done by injuring it. From the appearance of the first tooth on through to the cutting of both temporary and permanent sets, the teeth should be carefully and gently brushed once or twice a day. Neglect of this predisposes the teeth to become carious, and should this occur, the child should be referred to a good dentist and have the carious teeth filled or extracted. Carious teeth are not only unsightly, but they give rise to bad breath, pain, and frequently form the starting-point for infection.

Care of the Genital Organs.—The genital organs of children should receive attention, particularly as to cleanliness. In the male child if the foreskin is long and the preputial orifice of normal size, simply drawing back the former and carefully, but thoroughly, cleansing the glans with warm borax water or with Castile soap and water is enough. When the preputial orifice is somewhat contracted and adherent, the adhesions should be broken up by gently rotating the closed blades of a small pair of dressing forceps about the glans, after which the prepuce should be stretched gradually from day to day until the foreskin can be drawn easily back over the glans. When the foreskin is very long, circumcision should be done.

The genital organs of female children require little but simple cleanliness.

The Nursery.—The nursery must be a fairly large room, preferably facing the south, so that plenty of sunlight can enter it freely. If possible, it should not be on the ground floor or, on the other hand, it should not be at the top of so many flights of stairs as to be inconvenient. It should be heated by an open fire or, as Holt recommends, by a Franklin radiator. Steam heat or gas should not be used. Ventilation is of the greatest importance, and at the same time direct drafts are to be avoided; this can be accomplished best by any of the usual forms of ventilators which are designed to be placed in the windows. The furniture should be simple in style, not too much in quantity, and of plain, solid surface, not basket woven, so that it can be easily cleaned. All heavy hangings are to be condemned. The floors should be covered with rugs, tightly fastened to prevent the child or nurse with the baby in her arms from tripping. The bed on which the child lies should be furnished with a hair mattress and a pillow of the same material; no hangings of any sort should be used about the bed. Cradles that rock are an abomination, and should be excluded. For lighting a nursery

oil or gas may be used; the former presents many points of usefulness providing the lamps can be so placed that they can not be upset; on the whole, gas is to be preferred. At night a small wax night-light is all that is required. The temperature of the room should not be above 70° F. (21.1° C.) during the day and about 64° F. (7.8° C.) at night. The nursery should not be used as a place for drying diapers and clothes generally; nothing can be more unhealthy, not to say disgusting, than to see a line filled with diapers hanging in front of a nursery fire—a sight much too familiar to many physicians.

CHAPTER IV.

FEEDING AND FOOD OF INFANTS AND CHILDREN.

Probably the most important factors in the care of infants and young children are the selection and preparation of their food and the manner and regularity in which it is given. Nature has provided in the milk of the healthy human female a food perfectly adapted to the needs of the infant. When the secretion of milk is plentiful and of good quality, the question of the nourishment of the child is a very simple one. It is only when various disturbing causes affect the mother's milk and artificial foods must be resorted to that the regulation of the one and the selection of the other are matters which require much thought and considerable scientific knowledge. The infant may be fed in one of four ways: from the mother's breast, from the breast of a wet-nurse, by the milk of animals so modified as to resemble human milk, and by foods containing starch or maltose. It is a mistake to suppose that in all cases the mother's milk is the best food for the child. It is only when it is of such quality and quantity as to be thoroughly adapted to the digestive organs of the infant that it fulfils all that is required of it. In order to supply a good quality of milk the mother should be strong and healthy, provided with proper food, and be maintained in good hygienic surroundings. She should have a reasonably even temperament and be desirous and willing to take upon herself the various responsibilities of her position and to make it her special mission to fit herself for the duties of nurse. During the period of lactation all other responsibilities must give way to those of the care and feeding of her child.

FEEDING FROM THE BREAST.

The Breast.—The breast is a compound racemose gland, whose glandular tissue is lined with a peculiar type of epithelium endowed with the power of extracting from the blood the peculiar properties of fat, proteids, and sugar which, held in suspension in water and combined with salts, form that peculiar emulsion which

we call milk. The secretion of milk, and, indeed, the formation of its various component parts, may be influenced by many causes. It has been many times proved that the various emotions, changes of atmosphere and food, overexertion, mental depression or shock, and many other causes will change the composition and qualities of milk so as to render it indigestible. Even variations in the regularity of the intervals between nursings may produce an effect upon the milk; thus, as Rotch has pointed out, a prolonged interval lessens the solid constituents in their proportion to the water, while a too short interval increases the amount of solids in proportion to the water in the milk. It is also possible that the appearance and, to a greater extent, the continuance of menstruation influence the quality of milk, and pregnancy certainly does so to a very marked degree.

An infant should be put to the breast within from two to four hours after birth, or as soon as the mother is thoroughly rested from her labor. At this time, except in rare instances, very little milk is secreted, and the infant will get practically nothing but colostrum, which has a slightly laxative effect. It will often be found that at first, and at several subsequent attempts at nursing, the infant fails to take hold of the nipple, and some method must be adopted to teach the child how to nurse. This can be best done by drawing the nipple out carefully and moistening it with a little sugar and water or barley-water or, better, by squeezing gently a drop of milk from the nipple. This must be done before each nursing until the child learns how to take the nipple itself. It is of great importance that the child shall early be accustomed to regular hours of feeding during the first week of life or until the milk secretion is thoroughly established. The infant should be put to the breast every two hours during the day, and if asleep, should be awakened and encouraged to nurse, rather than allowed to get into the habit of nursing at irregular intervals. This is of importance not only for the child, but also for the proper maintenance of the quality of the mother's milk. At night, however, it is well both for the sake of the mother and child that the nursing should not be attempted at so frequent intervals as during the day. The digestive organs of the young infant need the night in which to rest, just as do those of the adult, and it is only fair that the mother should also enjoy this time for rest and repose. However, as the interval, say from 10 P.M., the time of the child's last nursing, until early in the morning, is rather too long for a young infant to go without some nourishment, it is well that it should be put to the breast once during this time. The following table gives the number of feedings for

the day and night and the intervals between each from birth to the end of the first year:

Age.	Intervals.	Number of Feedings in Twenty-four Hours.	Number of Night Feedings.
From birth to 4 weeks, . . .	2 hours.	10	1
From 4 to 6 weeks, ...	2 "	9	1
From 6 to 8 weeks, ...	2½ "	8	1
From 2 to 4 months, ...	2½ "	7	0
From 4 to 10 months, . . .	3 "	6	0
From 10 to 12 months, . . .	3 "	5	0

The length of time during which the child should be allowed to nurse at each feeding must vary a little according to the amount of milk secreted, its quality, and the general condition of the child. The fairly strong infant a week old will be able to retain in its stomach from one to three ounces of milk, and to get this will require that the child be kept at the breast, on an average, for about fifteen minutes. After the third day or on the beginning of the fourth the secretion of the milk is well established. The filling of the breasts is sometimes accompanied by a slight rise of temperature and some nervous disturbance. The breasts at this time become swollen, tense, and more or less painful. After the secretion of milk is thoroughly established the child must be put to the breast at regular intervals; this is of the utmost importance not only to the infant, but also to the mother, as regularity in nursing helps the breasts to produce a milk of even quality and quantity. It is of importance that the mother, especially if the child be her first, be taught how to nurse it, and also how to regulate her own life, diet, exercise, etc., so as to keep the nutritive properties of her milk in the best possible condition. This knowledge does not come by instinct in the majority of cases, as many seem to believe, but must frequently be taught by the physician.

While feeding from the breast, the infant should be held partly on the side, and may suck from the right or left breast, the better plan being to nurse it from each breast alternately. The mother should sit in a comfortable position, on a rather low chair, with the body bent slightly forward and the nipple drawn out so that the child can easily take hold of it. One of the mother's hands may be used to regulate the flow of the milk by placing the first and second fingers above and below the nipple. It is of the greatest importance that when nursing the child the mother should not be overheated, or have recently suffered from

any profound nervous disturbance. After the child has been satisfied, the nipple should be washed with a mild solution of boric acid, and in many instances it is well that the child's mouth should be treated in the same manner. In cases where fissures or erosions of the nipple occur and nursing is extremely painful, a nipple-shield may be used. Of these, many styles are on the market; probably the best is made of a simple bell of glass to which is attached a rubber nipple. Care should be taken that these nipple-shields be kept scrupulously clean, or they may cause infection of the breast. Although intervals of about three hours between each feeding may be well followed in the majority of cases, still no fixed rule can always be maintained, as all women do not secrete the same quantity and quality of milk, and one infant may not take the same amount in a given time as another; but it is of the utmost importance that whatever interval be first adopted, this shall be maintained, unless there is some exceedingly good reason for changing it. When the secretion of milk is plentiful, the child should be kept on breast milk alone until about the eighth or ninth month, when the child should be gradually weaned. The best method of doing this is gradually to substitute modified milk for breast feeding at the rate of one artificial meal every second twenty-four hours. At first no two artificial feedings should follow immediately after each other. At the commencement of the artificial feeding a formula should be used which contains slightly less proteids than the mother's milk, and this element should be gradually increased, providing the infant's digestion bears it well, until whole cow's milk is taken. This will be at about the tenth or eleventh month. As the child grows older one of the proprietary foods containing maltose or starch, which can be given mixed with milk, may be used as a food. A small amount of animal food in the form of broths or finely chopped tenderloin should be given once a day.

Contraindications to Breast Feeding.—Women who are affected with acute fevers, syphilis, tuberculosis, or any form of wasting disease should not, as a rule, nurse their children. Women who have uncontrollable attacks of temper or who are subject to violent emotions do not, as a rule, make good nursing mothers. Unwillingness to nurse the infant, irregularities in rest and exercise, continued indiscretions in diet, are all classed as contraindications to nursing.

Diet and Hygiene of Lactation.—It is of the greatest importance that the nursing mother be given a diet of good wholesome food containing all the elements necessary to keep her general

health in the best possible condition. Food undoubtedly exercises a potent influence over the formation of milk. During the lying-in period the diet should be light and at the same time of sufficient quantity. It should consist of milk, soup, vegetables, bread and butter, and gruels. After the first week, meat in moderate quantities should be given. Weak tea and coffee may be allowed in small quantities, and cocoa and chocolate are both nutritious and pleasant. The malt liquors have been used for the purpose of stimulating the secretion of the milk, but it is questionable whether they are of much value for this purpose. Fish may be used sparingly, since in some instances it possibly may have a certain deleterious effect upon the milk. Exercise in the open air is of great importance in maintaining the equilibrium of milk secretion ; the amount, however, must be arranged to suit the strength of the individual and should be regularly practised.

Deficiency in the Secretion of Milk.—When the secretion of milk is poor, we should first attempt to stimulate it before taking the child from the breast and depending for its nourishment upon the use of any of the much inferior modifications of cow's milk or the still worse artificial foods. The secretion of milk can be stimulated by increasing the amount of milk-producing foods which the mother should take. The best of these, probably, is the extract of meats in the form of broths or soups. It has been many times proved that a diet largely of proteids will increase the quantity of all the elements in the milk. Rotch has also pointed out that a diet consisting largely of fats will not increase that element, but rather decrease it in milk. Next in efficiency are milk, cocoa, and chocolate taken at meals once or twice a day. As has been before stated, some of the malt liquors, particularly beer and porter, are sometimes used to stimulate the secretion of milk, but the prejudice against them and the danger of forming the alcohol habit should make us extremely careful as to whom we recommend their use. Certain drugs, also, are of service for this purpose ; foremost among these we have castor oil, given in small doses—say from ten to fifteen drops in a soft capsule and repeated four or five times a day. Pilocarpin, given in the ordinary medicinal doses, may be of some value in increasing the quantity of milk. Massage of the breasts performed once or twice a day is a useful adjunct for this purpose.

Regulation of diet, exercise, and general mode of life do much to improve the quantity and quality of milk in a woman whose secretion is deficient. When the watery elements are deficient in quantity, these can often be corrected by allowing

the woman to drink a larger amount of liquids. Too large a proportion of *water* can be reduced by decreasing the amount of fluids taken or by the administration of saline cathartics. The latter method should be used with caution as it sometimes produces colic and diarrhea in the child.

TABLES SHOWING TYPICAL ANALYSES OF A NORMAL, A POOR, AN OVERRICH, AND A BAD HUMAN BREAST MILK.—(*Rotch.*)

	Normal Milk. Healthy life as to exercise and food.	Poor Milk. Starvation.	Overrich Milk. Rich feeding; lack of exercise.	Bad Milk. Pregnancy, disease, etc.
Fat, ...	4.00	1.10	5.10	0.80
Sugar, ...	7.00	4.00	7.50	5.00
Proteids, ...	1.50	2.50	3.50	4.50
Ash, ...	0.15	0.09	0.20	0.09
Total solids, .	12.65	7.69	16.30	10.39
Water, ...	87.35	92.31	83.70	89.61
Total, . . .	100.00	100.00	100.00	100.00

SHOWING THE EFFECTS OF MENSTRUATION ON HUMAN MILK.

	Normal.	Second Day of Menstruation.	Seven Days after Menstruation.	Forty Days after Menstruation.
Fat, ...	4.00	1.37	2.02	2.74
Sugar, ...	7.00	6.10	6.55	6.35
Proteids, ...	1.50	2.78	2.12	0.98
Ash, ...	0.15	0.15	0.15	0.14
Total solids, .	12.65	10.40	10.84	10.21
Water, ...	87.35	89.60	89.16	89.79
Total, . . .	100.00	100.00	100.00	100.00

When the *total quantity* of milk is too great, the amount of liquids should be decreased and the total quantity of food somewhat limited in amount. When the total amount of *solids* is too small, the nursing intervals should be shortened, the amount of liquids decreased, and less exercise should be recommended. When the *total amount of solids* is too large, the nursing interval should be prolonged, the amount of exercise should be increased, as should also the proportion of liquids in the mother's diet. When the *fat* is deficient in quantity, the proportion of meat in the diet should be increased. The reverse of this is indicated when the amount of fat is too

great. When the percentage of *proteids* is too low, the exercise should be decreased, the amount of proteid diet increased, and when the amount of *proteids* is too high, the amount of exercise should be increased up to the limits of fatigue, and the proteids in the diet decreased in quantity.

In cases in which there is an oversecretion of milk and the breasts become pendulous, it is of great use to support them by means of a firm binder made of one or two thicknesses of muslin passed around them and pinned from below upward. This binder should be removed at the time of nursing.

Disturbances of Lactation.—The chief causes of the various disturbances of lactation are menstruation and pregnancy; the former may or may not produce change of sufficient consequence to warrant the weaning of the child. Not infrequently, by pumping the breasts during the time of the menstrual epoch, it is possible to tide both mother and child over these periods, and nursing may be continued afterward. As a rule, however, the continuance of menstruation affects the composition of the milk to quite a marked degree. Pregnancy, as a rule, creates a much greater disturbance in the equilibrium of milk secretion than does menstruation, so much so that as a general rule it is probably best to wean the child as soon as it is known that the mother is pregnant. The table on page 99 will show the variations in milk due to menstruation, pregnancy, and marked abnormalities in nutrition.

WEANING.

The age at which the child should be weaned can not be definitely fixed, as it varies somewhat with the amount and richness of the milk secreted by the mother and the general condition of the child. In the majority of cases it is not considered desirable to continue breast feeding beyond the eleventh or twelfth month. If it is at all possible, a child should not be weaned before the starch-digesting (amylolytic) function of the digestive apparatus is well developed. This does not occur before the sixth or eighth month, or, in other words, about the time the first four incisor teeth are cut. Let us say, then, that a child may be weaned at about the ninth month. After the twelfth month the child needs a stronger food than the mother's milk affords, and continued lactation, heretofore a purely physiologic function, begins to cause a considerable drain on the vitality of the mother. Many authorities believe, and, indeed, in a number of cases facts seem to prove, that from this time the

milk slowly becomes poorer in quality, and this is particularly apt to be the case if menstruation or pregnancy appear and continue. It is best that a child should not be weaned during the intense heat of midsummer, because of the danger of gastro-intestinal infection from cow's milk or other methods of artificial feeding. If possible, it is preferable to wean an infant during one of the interdental periods and in the cooler months of the year. The infant may be weaned either suddenly or by the gradual substitution of an artificial diet. The former method is only indicated when there is a continued and persistent refusal on the part of the child to take the breast, or when the milk becomes suddenly changed from any cause, so as to have a bad effect upon the infant's health. Should the mother become affected with any disease, such as erysipelas, cancer, tuberculosis, or the acute fevers, we must regard this as an indication for the rapid withdrawal of breast feeding. An infant may be gradually weaned by mixed feeding in the following manner: If the child be put to the breast every three hours, there should, during the first week, be one artificial feeding introduced daily. During the second week two artificial feedings and five breast feedings may be given, and in this manner increasing the number of artificial feedings by one and reducing the number of nursings in the same proportion until the child is fed entirely on an artificial diet.

METHOD OF GRADUAL WEANING.—(*Cantley.*)

	First Week.	Second Week.	Third Week.	Fourth Week.	Fifth Week.
5 A. M.,	Breast.	Breast.	Breast.	Breast.	Breast.
8 A. M.,	Mixture.	Mixture.	Mixture.	Mixture.	Mixture.
11 A. M.,	Breast.	Breast.	Breast.	Mixture.	Mixture.
2 P. M.,	Breast.	Breast.	Mixture.	Mixture.	Mixture.
5 P. M.,	Breast.	Breast.	Breast.	Breast.	Mixture.
8 P. M.,	Breast.	Mixture.	Mixture.	Mixture.	Mixture.
11 P. M.,	Breast.	Breast.	Breast.	Mixture.	Mixture.

It is of importance to know, and it sometimes requires no little study and care to find out, what food shall be used to replace the mother's milk in these cases.

At the present time the opinion of the majority of those who have carefully studied infant feeding seems to be in favor of substituting suitably modified cow's milk for that of the mother when the child must be weaned. If the mother is healthy and

her milk agrees with her baby and the latter is increasing in weight, the substituted food must be made to correspond in the proportion of its elements as nearly as possible to her milk, an analysis of which should be made. When the weaning is necessary before the ninth month, such an analysis is particularly required. In case the mother's milk has not agreed with the child and weaning has been imperative on that account, an analysis will show which milk element is at fault, and this must be corrected in the milk mixture; it must always be remembered that the proteids of cow's milk are more indigestible than those of the mother; therefore it is well to start with a mixture containing a somewhat lower proportion of proteids than the mother's milk contains.

From the beginning of artificial feeding the child should be weighed at regular intervals, and its digestion, bowel movements, and general condition carefully watched. If the infant loses weight, the food is insufficient in some way, and, as will be shown later, the milk element which is at fault will very often show in the character of the stools or general symptoms.

After the child has been entirely weaned and is on a diet composed exclusively of modified milk, a mixture having been made which is agreeing, it should be our aim to raise, first, the total quantity as the infant's gastric capacity increases, then the proportion of proteids should be increased, and, as the child grows older, the quantity of fat diminished. If the child has been weaned at the end of the usual period of lactation, say ten or eleven months, and the mother's milk has agreed up to that time, the child should be gradually weaned, and at first fed with a milk mixture corresponding with the proportions of the mother's milk. As soon as a formula has been made which agrees, the proteids should be rapidly increased, the ultimate object being to train the digestive organs to assimilate unmodified cow's milk. This will be about at from the twelfth to the fourteenth month. In the practice of many physicians, especially those residing in the country, it is a hard matter to have milk analyses made, and some simpler method must be used.

It is difficult, in fact impossible, to make a milk formula which will fit all cases, but, as a rule, in starting a child on a milk mixture it is best, for the first few days, to give a formula low in proteids and rather rich in fats and sugar if the child is between three and six months of age. As a first formula for a child three months old the authors have had good results from a mixture of:

Fat,	4.00
Sugar,	6.00
Proteids,	1.00
Lime-water,	5.00

This can be made as follows:

Cream containing 16 per cent. fat,	1 ounce
Boiled water,	22½ drams
Lime-water,	1½ "
Milk-sugar,	½ dram.

This is, however, an arbitrary formula, based on personal experience only. We have also found the following, devised by Rotch, most useful as a basic formula for a child two or three months old which must be fed artificially. This consists of:

Fat,	2.00
Sugar,	5.00
Proteids,	0.75
Lime-water,	5.00

And is made as follows:

Cream,	4 ounces
Milk,	none
Lime-water,	1 ounce
Water,	15 ounces
Milk-sugar,	7 drams,

Or half the quantity of granulated sugar. The cream used contains 10 per cent. of fat.

In these milk formulas our idea is simply to describe a type of milk mixture. In every case the milk elements must be changed to suit the digestion of the particular child. The average infant of three months will not long thrive on a food of so low a proteid proportion as the one given, but it seems best, in our experience, to start with a mixture which can reasonably be expected to be well taken from the first. Should a mixture such as the one here described be assimilated by the child, the proportion of all the elements, especially the proteids, can be steadily increased a small quantity at a time, the index in all cases being the increase in the child's weight, absence of indigestion, colic, and abnormal stools. When the child is weaned at the end of lactation,—eight to ten months,—the following may be given:

Fat,	4.00
Sugar,	5.00
Proteids,	3.00
Lime-water,	5.00

Cream,	8 ounces
Milk,	7½ "
Lime-water,	1 ounce
Water,	3½ ounces
	20 cunces.
Milk-sugar,	3½ drams.

Or half the quantity of granulated sugar, a 10 per cent. cream being used.

In a few weeks may be prescribed the following:

Fat,	4.00	Cream,	8 ounces
Sugar,	5.00	Milk,	8 "
Proteids,	3.25	Lime-water,	1 ounce
Lime-water,	5.00	Water,	3 ounces
			20 ounces.
		Sugar of milk,	3 drams,
		Or half the quantity of granulated sugar.	

Or by—

Fat,	4.00	Cream,	8 ounces
Sugar,	4.50	Milk,	12 "
Proteids,	3.50		

As the child advances in age it may take whole milk, preferably Pasteurized, and later animal broths or a small quantity of finely hashed tenderloin steak once a day. The discussion of the amount of food which should be given at any stated age and the feeding of older children will be considered in a subsequent chapter.

FEEDING BY A WET-NURSE.

The advantage of this method of feeding is that the infant gets the benefit of being nourished by human milk with all its peculiar and valuable properties. The disadvantages are that wet-nurses are somewhat hard to get, and, when procured, there is some danger of the child becoming infected with such diseases as syphilis, rickets, and tuberculosis. In selecting a wet-nurse certain facts must be borne in mind: In the first place, she should be subjected to a rigid examination and demonstrated free from all taint of the diseases before mentioned or others. She should not be less than twenty-one years of age and not more than thirty-five. A very young wet-nurse is apt to be objectionable, partly from her methods and habits of life, partly from the fact that the milk is frequently of poor quality, and, besides, as a rule, she has but little knowledge of the care of children. It is of importance that her own child should be of about the same age as the child she intends to nurse, although some authorities consider it well that the nurse's child be five or six months older than the one she is to care for. She should be in good health, not too fat, and of a placid disposition. Her breasts should be of good shape, well developed, and with good-sized, well-formed nipples. Before engaging a wet-nurse it is of great importance that a careful analysis of her milk be made, and that the latter be of a quality equal to the average standard of good human milk.

FEEDING BY THE USE OF MODIFIED MILK OF ANIMALS.

In the largest proportion of cases where the mother can not nurse her child from the breast, we must find a substitute in the milk of the cow or some other animal, either used in its original condition or modified in some form so as better to adapt it to the needs of the infantile digestive apparatus, or else use some proprietary food containing principally starch, dextrin, or maltose. For the purpose of feeding the human infant, cow's milk has the greatest degree of practical utility, from the ease with which it can be obtained and modified and on account of its mechanical composition.

The milk of the ass and of the goat is considerably used by the natives of the countries in which these animals are largely raised, and is of undoubted use. For nutritive properties and readiness of assimilation ass's milk stands quite high, but the difficulty of obtaining it makes it of little use in this country. An analysis of its constituents gives the following result:

ASS'S MILK.—(*Peligot.*)

	Milking Intervals.		
	One and a half hours.	Six hours.	Twenty-four hours.
Butter,	1.55	1.4	1.23
Sugar,	6.55	6.4	6.33
Casein,	3.46	1.55	1.01

The milk of the goat can be quite easily obtained, and is useful in certain cases. An analysis of a specimen made for the authors at the City Laboratory of Philadelphia gives its composition as follows:

Fat,	5.85	per cent.
Albuminoids,	4.49	"
Milk-sugar,	5.11	"
Mineral matter,	0.88	"
Water,	83 67	"
	100.00	"

The composition of cow's milk differs considerably from that of the human female. In the milk of the cow the proportion of proteids is much greater than in human milk, while the amount of sugar (lactose) is considerably less. Fat is present in about

the same quantity in both, but its proportion to other elements is lower in cow's milk than in human milk. The quantities of fat, sugar, and proteids found in cow's milk vary greatly in different specimens examined. Starr gives the comparative proportions of both as follows:

SOUND DAIRY MILK.

Reaction,	Feebly acid
Specific gravity,	1.0297
Bacteria,	Always present
Fats,	3 to 6, average 3.75
Lactose,	3.5 to 5.5, average 4.42
Albuminoids,	3 to 6, average 3.76
Ash,	0.6 to 0.9, average 0.68.

HUMAN MILK.

Reaction,	Persistently alkaline
Specific gravity,	1.0313
Bacteria,	Seldom present
Fats,	2 to 7, average 4.13
Lactose,	5.4 to 7.9, average 7
Albuminoids,	0.85 to 4.86, average 2
Ash,	0.13 to 0.37, average 0.2.

And Rotch, in an analysis of 24,000 specimens of cow's milk, found the following results:

COW'S MILK.

Reaction,	Slightly acid
Specific gravity,	1.032
Water,	86 to 87 per cent.
Total solids,	13 to 14 "
Fat,	4 "
Milk-sugar,	4.5 "

Colostrum is a fluid which is secreted by the mammary gland before the true secretion of milk appears. This fluid is of a yellowish color, and contains more proteids and salts and less sugar and fat than ordinary milk. It has a specific gravity of 1040 to 1046, and a strongly alkaline reaction. Heat coagulates it into solid masses, and it may also coagulate spontaneously. Microscopically, the fat-globules are of unequal size, and among them will be seen large granular bodies known as colostrum corpuscles. These are probably epithelial cells which have undergone fatty degeneration.

COMPOSITION OF HUMAN COLOSTRUM.—(*Pfeiffer.*)

Proteids,	5.71
Fat,	2.04
Sugar,	3.74
Salts,	0.28
Water,	88.23
	100.00

The colostrum corpuscles diminish in number a few days after the birth of the child and disappear in about two weeks. Colostrum is generally considered to have a laxative effect on the intestines of the new-born infant.

A glance at the foregoing tables will convince us that whenever the milk of the cow or of another animal is used for infant feeding, considerable modification will be necessary before it approximates in its composition human milk. If we turn to the list of artificial foods, we find that in all starch, dextrin, or maltose is the predominating factor. Now, we know that the digestive apparatus of the young infant up to the sixth or eighth month either can not digest starch at all or can only do so by being forced; therefore these foods, as a rule, should be passed by, or, if necessity compels their use, it should only be for a short time. The human infant in the first six or eight months of its life needs a diet of milk, the constituents of which are all necessary to its growth. As a rule, young children do not thrive well for a long time on a diet of starch or maltose. When these foods are mixed with milk, their nutritive properties are increased, but it is principally the milk that nourishes rather than the patent food which is mixed with the milk. We are compelled to acknowledge that as yet the best substitute to replace mother's milk is to be found in the milk of one of the mammals. Looking over the analyses of the milk of those animals which are at all available, we find that the milk of the cow offers the most convenient source of supply, and while it may not, in the proportion of its elements, approximate quite so nearly to human milk as that of some other animal, yet it is easy to obtain and is in a high degree susceptible of satisfactory modification.

Milk as a food contains in a condensed form all the elements necessary for the sustenance of the young animal of any species. In it we have the carbohydrates, the element necessary for the production and maintenance of bodily heat; the proteids, which are needed to build up and repair tissue waste, and the fats, which also aid in the maintenance of the bodily heat and give rotundity to the form. Along with these we have an amount of earthy salts necessary to aid in cell-formation, and particularly in the building up of the bony structures of the body. Before taking up the subject of the adaptation of cow's milk as a substitutive food for the infant, we must consider for a moment the composition of human milk. As the milk comes from the breast, and before it is contaminated by contact with the outer surface of the nipple or the child's mouth, it is an absolutely sterile fluid, and

consists of what is practically a finely divided emulsion of fat and proteids (milk fat and casein) suspended in a weakly alkaline solution of salts and containing a definite proportion of sugar (lactose). This fluid is warmed to the temperature of the body, and in the breast of a woman in good health is absolutely free from bacteria. The proportion of the various elements is subject to considerable change, according to the health and habits of the individual and the period of lactation. Some authorities claim that there is an increase in the casein or caseinogen until the second month, from which time it diminishes until the ninth month; this, however, is by no means a constant rule. It is possible that the quantity of lactose may increase from the second to the eighth month. The liquid portion of the milk is derived from the blood; the other properties, such as casein or caseinogen, fat and sugar, are the special products of the secretory cells of the mammary gland. The milk fat, or butter, in the form of finely divided globules, is held in suspension in the liquid part of the fluid.

The period of greatest activity in the secretion of milk is from ten months to a year following the birth of the child. In the largest proportion of cases the most abundant secretion is during the first six months of this time, and at the end of this period the quantity and quality of the milk are at their best. Should the child die, or for any reason be prevented from nursing, the secretion of milk rapidly diminishes and disappears.

Rotch has given the following table showing the composition of a number of specimens of good breast milk from the third to the ninth month of lactation:

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Fat, ...	2.00	2.00	2.00	3.00	3.50	4.00	4.00	4.00	4.50
Milk-sugar, .	6.00	6.00	7.00	6.00	6.50	6.00	6.00	7.00	7.00
Albuminoids,	1.00	1.50	1.50	1.00	1.50	1.00	2.00	2.00	2.50
Mineral matter,	0.17	0.25	0.25	0.17	0.25	0.17	0.33	0.33	0.41
Total solids,	9.17	9.75	10.75	10.17	11.75	11.17	12.33	13.33	14.41
Water, . . .	90.83	90.25	89.25	89.83	88.25	88.83	87.67	86.67	85.59
Parts, .	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Chemistry of Milk.—In order to better understand the reasons for the necessity of modification of cow's milk, we must consider briefly the various constituents of both cow's and human milk, remembering always that the elementary principles

of both are subject to very great variations according to the period of lactation and the results obtained by diverse analyses.

Fat.—Cow's milk, as a rule, contains about the same amount of fat as human milk. The fat is a mixture of glycerids of the fatty acids, the palmitic, stearic, and oleic, and the glycerids of certain volatile acids, chiefly butyric and others, such as caproic and caprylic. Over 40 per cent. of the fat consists of olein. Under the microscope the fat appears as minute, shining globules; these, in a fresh specimen, are uniformly spread over the field, not being collected in groups. The amount of fat in milk will vary much from time to time, more, indeed, than any other constituent of the fluid; as a rule, however, each cubic millimeter of cow's milk should contain from 2,000,000 to 3,000,000 fat-globules. High temperature will cause a partial separation of the fat, which will rise to the surface and form butter. The percentage of fat in average cow's milk will range between 3.5 and 4 per cent.

Sugar.—Sugar exists in milk in the form of lactose. According to Leeds, this element occupies a peculiar place in the carbohydrate group between cane-sugar and starch. Its principal function in the infant's body is to supply, by oxidation, the normal heat, which can not at this early age be kept up by locomotion and general muscular action. Under the influence of certain bacteria, principally the lactic acid bacillus, the lactose is partly decomposed in the stomach and forms lactic acid. A certain proportion passes unconverted through the stomach into the intestines, where, by the action of the secretions of the latter, it is changed into glucose, and thus enters the portal circulation. The proportion of sugar in cow's milk ranges from 4 to 4.5 per cent., whereas in human milk it averages from 6 to 7 per cent.

Proteids.—The nitrogenous portion of cow's milk shows many important differences from that of human milk. Both contain large quantities of lactalbumin and casein or caseinogen. The proportion of proteids is less in human milk than in cow's milk, the relation being about 1.5 per cent. in the former and 4 per cent. in the latter. These proteids represent the nutritive elements of milk. They are partially in solution and partially in suspension, as is seen by filtering milk through porcelain, when nearly all the caseinogen is left behind with the fat, while a small portion of the caseinogen and other products is easily recognized in the serum. The coagulable proteids in cow's milk exist in a comparatively larger amount than in human milk, so that under the same conditions a larger curd will be found in

the former than in the latter. The casein of cow's milk can be precipitated into the form of coagula by the addition of dilute acetic acid or by saturating with a solution of sulphate of magnesia. Precipitation of the casein can also be made by adding rennet to cow's milk, when this substance is thrown down in the form of soft, dense flakes. Human milk requires much more acetic acid to extract the casein than does cow's milk, and when the precipitation takes place, the casein does not occur in lumps, but as a fine powder which dissolves in an excess of acetic acid. The lactalbumin remains in a solution as whey after separation of the casein, and is rendered insoluble by boiling; it is said to resemble closely serum albumin (Leeds).

Inorganic salts found in the ash of milk contain principally the salts of lime, potassium, and sodium, usually in combination with chlorin and phosphoric acid. The following table represents the relation existing between the inorganic salts in cow's milk and human milk:

	Cow's Milk.		Human Milk.	
Potash,	24.5	0.18	33.78	0.07
Soda,	11	0.11	9.16	0.03
Lime,	22.5	0.16	16.64	0.03
Magnesia,	2.6	0.02	2.16	0.01
Oxid of iron,	0.3	0.0004	0.25	0.0006
Phosphoric acid,	26	0.2	22.74	0.05
Sulphuric acid,	1		1.89	
Chlorin,	15.6	0.17	18.38	0.04

Reaction.—Human milk as it comes from the breast is invariably slightly alkaline in reaction. Cow's milk, on the contrary, has a somewhat acid reaction, and Rotch states that this is the case whether the milk has been tested directly from the udder or has stood for twenty-four hours. Milk also contains small quantities of urea and citric acid.

DECOMPOSITION AND BACTERIOLOGY OF MILK.

Except in cases of local disease, human milk is usually considered sterile, and there is no doubt that so far as the milk within the mammary gland goes this is the case, as has been shown by the researches of Escherich, who examined the milk of twenty-five healthy women and found it absolutely without bacteria. Cohn and Neumann, on the other hand, found micro-organisms in the milk of forty-three out of forty-eight healthy women. The varieties of bacteria most generally present were the staphylococcus pyogenes albus and staphylococcus pyogenes aureus and the streptococcus pyogenes. Ringel, having examined the milk of twelve healthy and thirteen unhealthy nursing women,

found it sterile in three. Hönigman reports that in seventy-six examinations of the milk of sixty-four women recently confined he found it sterile in only four cases. The above-named bacteria were the ones most generally present. The number of micro-organisms in human milk varies much as to whether the specimen is from the first milk drawn or from that contained within the gland, the number of bacteria being much greater in the milk which first comes from the nipple than that within the milk-ducts. The milk last drawn from the breast is usually quite sterile.

Milk in the udder of the cow is practically sterile, but as soon as it is drawn the germs of decomposition can be found in it, although the utmost care in all details has been employed. Some bacteria are present in newly drawn milk. The barn, the cow, the milker, the hay on which the cow is fed, the bedding upon which she lies, the dust of the roads, from decaying vegetables, the common molds of cheese and bread, the ferment of butter-making even, to say nothing of the more extraordinary forms of bacteria, all have more or less effect in producing decomposition of milk. When milk is simply sour, it is because the common lactic acid bacteria have done their natural work upon the sugar. When milk is bitter and the curd separates in cloudy masses, it is because the so-called "lab-" ferments have acted upon the proteids. When milk is what is known as "blue" (though this must be carefully distinguished from blueness of common skimmed milk), it is because certain foreign bacteria have found their way into it. When milk is very red from causes other than the presence of blood, there is reason to suspect a very dangerous form of contamination. Ropy or stringy milk is probably the vehicle for some of the pyogenic bacteria or their products. Some of these sources of decomposition are derived from the farm and dairy. Many are, however, supplied plentifully by any ordinary kitchen, refrigerator, the air of the nursery, and the unclean condition of vessels employed in the home. The only way to obtain a perfect milk is to produce it in a scientific way and to employ all aseptic and antiseptic precautions necessary for its protection against contamination. For this purpose cold and heat are the means which can most conveniently be used to keep a good milk as nearly perfect as is possible. A temperature below 40° F. (4.4° C.) prevents the growth of the few bacteria that the very best must contain. Heat will kill most bacteria and all the pathogenic milk forms commonly met. It is probable that a temperature of 156° F. (68.9° C.) will render a milk safe for use, but it is seriously doubted whether heat can render an impure milk nutritious. It is certain, however, that a perfect milk will

remain so for an indefinite time at 35° F. (1.6° C.); at this temperature also a pure and good milk will remain unchanged for a sufficient time for dietetic purposes.

Sedgewick and Batchelder give the following figures to show the enormous number of bacteria present in ordinary cow's milk such as is served to consumers:

1. There were 67,143 micro-organisms in a cubic centimeter found in samples of milk from the tables of persons in the suburbs of Boston in an average of fifteen examinations.

2. Over 250,000 in a cubic centimeter were found in milk taken directly from the milk-carts in Boston in an average of fifty-seven examinations.

3. Over 4,500,000 in a cubic centimeter were found in milk obtained from Boston groceries. It is stated that in milk obtained from the milk-houses in London in 1896 the number varied from 848,400 to 8,119,200 in a cubic centimeter. Renk found from 6,000,000 to 30,000,000 in a cubic centimeter in the milk-supply of Halle.

THE PERCENTAGE COMPOSITION OF COW'S MILK AT DIFFERENT STAGES OF THE MILKING.—(*Harrington.*)

	Water.	Solids.	Fat.	Ash.
Fore milk,	86.66	13.34	3.88	0.85
Middle milk,	84.6	15.4	6.74	0.81
Strippings,	82.87	17.13	8.12	0.82

THE PERCENTAGE COMPOSITION OF FORE MILK AND STRIPPINGS.—(*Wynter Blyth.*)

(Specimens taken from two cows of different breeds.)

	Devon Cow.		Guernsey Cow.	
	Fore Milk.	Strippings.	Fore Milk.	Strippings.
Water,	90.319	83.94	88.4	83.394
Solids,	9.681	16.06	11.6	16.604
Proteids,	4.598	5.824	5.426	4.451
Casein,	2.387	4.304	4.708	3.435
Albumin,	1.83	0.975	0.451	0.86
Peptones,	0.381	0.545	0.257	0.156
Fat,	1.166	5.81	0.357	5.946
Sugar,	3.12	3.531	4.943	5.28
Ash,	0.797	0.805	0.874	0.929
Specific gravity,	1.0288	1.0256	1.04	1.023

Examination of Milk.—An analysis of the mother's milk should be made in all cases in which an attack of indigestion appears in a breast-fed infant. It is often necessary to test cow's milk in order to be sure that the specimen used in infant feeding is of standard quality. In making an examination of a sample of human milk it is of great importance to obtain the entire milk secreted at one nursing, or, when this is impossible, it is generally advised that a portion of middle milk should be taken. The quality of the milk both of the human female and of the cow will vary greatly during the emptying of the milk-glands, and on this account an examination of any one portion will prove unsatisfactory. The milk which is first drawn from the nipple is usually known as "fore milk." This contains a much larger percentage of water and a lower percentage of fat than does the bulk of the milk which is in the milk-glands. The last milk drawn is known as "strippings"; it contains less water and a higher percentage of solids and fats than does middle milk. The term "middle milk" is applied to the bulk of the milk which is in the mammary gland. The tables on page 112 will show the differences in composition of the three grades of milk.

PERCENTAGE OF TOTAL SOLIDS IN HUMAN MILK.—(*Reiset.*)

	Before Suckling.	After Suckling.
1,	10.58	12.93
2,	12.78	15.52
3,	13.46	14.57

A certain general idea in regard to the quantity and quality of the milk secreted may be had from the inspection of the breasts and from studying the manner in which the infant nurses. When the time spent in nursing is long, say from thirty to fifty minutes, the probabilities are very strong that the quantity is too small. On the other hand, if the breasts are conic in shape, hard, and full, the supply is probably abundant. A soft, flabby breast indicates a deficient supply of milk, and when noticed in combination with a prolonged period of nursing, the quantity of milk is almost certainly scant. Another method of testing the quantity of milk is to weigh the infant before and after nursing. This method would require very accurate scales, and is not always satisfactory. The quantity can also be measured by pumping the breasts at regular intervals throughout a given time, and estimating from this the amount secreted in twenty-four hours. The specific gravity is usually taken by means of a small hydrometer which should be graduated from 1010 to 1040.

An increase in the proportion of fat represented by the cream lowers the specific gravity of the whole milk. The specific grav-

ity increases with the proportion of other solid matter. The *reaction of milk* can be tested with ordinary litmus paper.

Microscopic Examination.—By means of the microscope we can determine in milk the size and division of the fat-globules, the presence or absence of colostrum corpuscles, and the presence or absence of blood, pus, or epithelium. The colostrum corpuscles are not generally found in milk after the twelfth day.

The estimation of fat can be made as follows: The glass cylinder

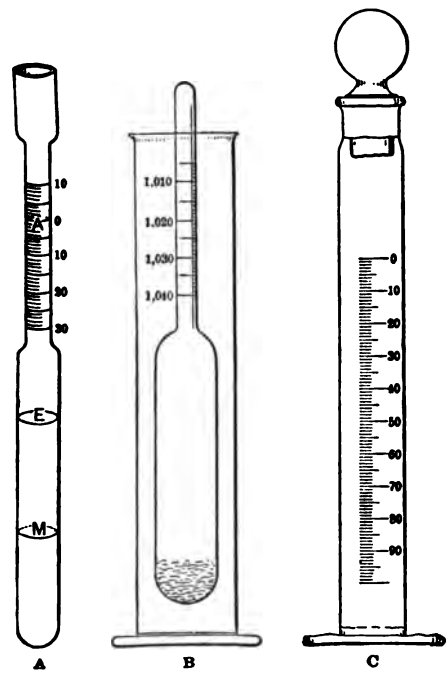


FIG. 15.—A. MARCHAND'S TUBE. B, C. HOLT'S LACTOMETER AND CREAM GAGE.

of the cream gage (see C, Fig. 15), which holds ten cubic centimeters, is filled to the zero-mark with freshly drawn milk. This should be allowed to stand at the temperature of the room—that is, from 66° to 72° F. (18.9° to 22.2° C.)—for twenty-four hours, at the end of which time the amount of cream is read off. The proportion of cream bears a relation to the proportion of fat contained in it as 5 is to 3. Thus, 5 per cent. of cream will indicate that the milk contains 3 per cent. of fat. A more accurate determination of the actual amount of fat can be obtained by the use of the Babcock centrifugal machine. By this method the fat

is brought to the surface by centrifugal action; previous to this the nitrogenous principles have been destroyed by sulphuric acid.

Another test is by the use of Feser's lactoscope. (See Fig. 16.) This test is made as follows: Four cubic centimeters of milk are measured off in a pipet, put into a tube, and water slowly added, shaking from time to time until the black lines of the porcelain stem at A are clearly visible through the mixture of milk and water. The percentage of fat is then read off on the glass cylinder at the level of the water added; thus, if the water is to the mark 4, it indicates the presence of 4 per cent. of fat. This test is only applicable to cow's milk.

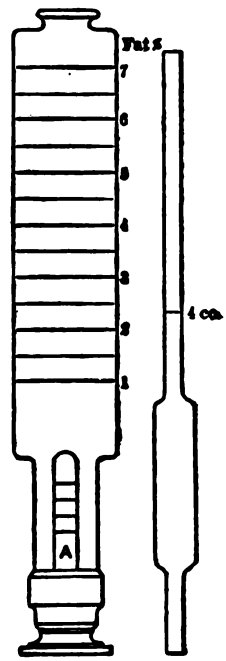


FIG. 16.—FESER'S LACTOSCOPE.

The test by the use of *Marchand's tube* (see A, Fig. 15) may also be used. This test can be made in the following manner: Five cubic centimeters of milk are first poured into the tube so as to fill it to the line M, after which four or five drops of liquor sodæ are added; the mixture is well shaken, and five cubic centimeters of ether are inserted so as to bring the mixture to the line E. The tube is now corked and shaken fifteen to twenty times, after which it is filled to the line A with 96 per cent. alcohol. The tube should now be tightly stoppered and shaken thoroughly, after which it is placed upright in a tall bottle containing water at a temperature of 120° to 150° F. (48.9° to 65.6° C.). The fat separates and forms a distinct layer at the top, and after half an hour the amount can be read off in degrees.

The percentage of fat represented by each degree of the instrument can be seen in the following table:

DEGREES, MARCHAND.	PERCENTAGE OF FAT.	DEGREES, MARCHAND.	PERCENTAGE OF FAT.
1	1.49	13	4.29
3	1.96	15	4.75
5	2.42	17	5.22
7	2.89	19	5.68
9	3.36	21	6.14
11	3.82		

Each additional degree on the tube corresponds to 0.23 per cent. of fat.

Another test for the fats of milk may be made as follows: Five cubic centimeters of milk are put in a stoppered tube graduated to 50 c.c., and shaken up with 10 c.c. of strong hydrochloric acid. Next, place in a hot-water bath until the mixture turns dark brown in color, this change being due to the conversion of lactose into maltose; it will again become clear except for a small amount of floating coagulum of lactalbumin. It is then cooled under the tap, and when cold, 35 c.c. of ether are added. The mixture is now well shaken up for a few minutes and allowed to stand. In fifteen minutes the fluid will be seen to consist of three layers—an upper clearer layer of ether containing fat; a lower clearer layer of acid albumin, water, etc.; and a narrow, intermediate flocculent white layer, about half an inch thick, of coagulated albumin. Read off the depth of the ether layer from the 50 c.c. mark to the middle of the layer of coagulated albumin. Then measure off rapidly two portions of 10 c.c. each, taken from the ether layer, into platinum capsules which have previously been weighed. Place these in a hot incubator, and when the contents have been converted to dryness, they should be weighed. Take the mean of the two estimations, and from that calculate the weight of fat in the lower ether layer: that is, of the 5 c.c. of milk under examination. Multiply by twenty to obtain the weight of the fat in 100 c.c. of milk (Schmidt's method).

Cream.—Cream must be regarded as milk which contains an excess of fat (Holt). Cream is obtained in one of three ways: by skimming, by the gravity process, and by the use of a centrifugal machine or separator. With a given specimen of milk, the faster the separator is run, the denser will be the cream. The following table will show the proportions of the various constituents of separator cream of four different densities as compared with good cow's milk:

	Whole Milk.	Cream.			
		I.	II.	III.	IV.
Proteids, ...	4	3.9	3.8	3.6	3.2
Fat, ...	4	8	12	16	20
Sugar, ...	4.3	4.3	4.2	4	3.8
Salts, ...	0.7	0.7	0.64	0.6	0.55

Cream is known by the percentage of fat it contains ; thus, in column I, the figure 8 represents an 8 per cent. cream ; in column II, 12 represents a 12 per cent. cream, etc. The best centrifugal cream contains from 25 to 40 per cent. of fat. The reduction of proteids in cream as compared with milk is but slight, being less than 1 per cent. Cream may be obtained by the gravity process as follows: Put one quart of average milk into a glass jar. This jar must be placed in iced water for four or five hours, at the end of which time it will be found that about ten ounces of cream can be taken from the top of the jar. Cream raised in this manner will contain, on an average, about 8 per cent. of fat. If the jar is allowed to remain untouched for six hours, about six ounces of 12 per cent. cream can be taken off. The cream may be removed by skimming, or, what is more usually done, the milk at the bottom of the jar is siphoned off, leaving the cream still in the jar.

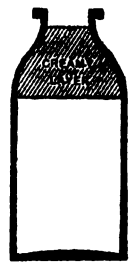


FIG. 17. TWELVE PER CENT. CREAM.

Another method of separating cream is by the use of the Cooley creamer. This consists of a wooden tank lined with metal, and of sufficient size to hold two or more cans of milk. The cans hold eighteen quarts and are so covered that they can be submerged. The bottom of each can is inclined, and at the lowest point of the incline is placed a faucet. A small piece of glass is inserted into the side of the can, so that the level attained by the cream can be seen. The cans are filled and placed in the tank of iced water. At the end of six or twelve hours the lower portion of the milk is drawn off and the upper layer, containing the cream, remains in the can. By this process any percentage of cream can be obtained. The percentages most commonly used are 8, 12, and 16.

Estimation of Lactose.—Dilute 10 c.c. of thoroughly mixed milk with 50 c.c. of distilled water and add dilute acetic acid. Filter off the precipitated caseinogen, mash up, and wash the precipitate two or three times with water, and add the washings to the filtered precipitate. Raise this precipitate up to a known quantity, say 200 c.c. Place this in a buret, and estimate by means of a standard Fehling's solution.

Estimation of Salts of Milk.—To make this test take a platinum capsule containing the dried salts of milk, and heat it until all the contents are incinerated and only a white ash remains. Care should be taken not to heat the capsule to redness, otherwise small portions of the salts may be volatilized.

Estimation of Proteids.—The estimation of the proteids in milk can only be determined in a general way. The following rules will give some idea of the relative quantity present. If the quantities of sugar and salts are so nearly uniform as not to affect the specific gravity, an approximate estimation of the proteids may be made after having obtained the specific gravity and the percentage of fat. The specific gravity will vary directly with the proportion of proteids, and inversely with the proportion of fat, or, in other words, when the percentage of proteids is high, the specific gravity will also be high. When the proportion of fat is high, the specific gravity will be low.

In endeavoring to estimate the proteids the specimen of milk used should be either from the whole quantity secreted in the breast during a given time or a specimen of middle milk.

Effect of Drugs on Mother's Milk.—While it has not been proved that all drugs are eliminated in part through the milk, yet a certain number, undoubtedly, are partially excreted in this manner. Their effect is usually more noticeable in poor milk than in milk of good quality. Among the drugs which particularly affect milk are the following:

Mercury.—The effect of this substance upon the milk is very slight except after long administration, and even then it is very doubtful whether its action is sufficient to be of any importance.

Opium.—It is possible that opium may be excreted in the milk in sufficient quantities to produce symptoms of poisoning in an infant. Its effects are more noticeable when the quality of the milk is poor. Holt states that a fatal case has been recorded.

Belladonna.—It is possible for this drug to cause quite marked symptoms in the child when administered to the mother in full doses.

Potassium Iodid.—This drug may produce its effect upon the child through the mother.

Saline cathartics undoubtedly affect the child when administered to the mother.

Iodoform.—When applied externally to the mother, this drug may be found in the urine of the child in the form of iodin.

Arsenic and antimony have been found in the milk after their administration to the mother.

Morphin in medicinal doses is eliminated as apomorphin in the mother (Pinani). This, however, has been doubted by several observers.

THE BREEDS OF COWS BEST ADAPTED FOR INFANT FEEDING.

There does not seem to have been much opportunity, either here or in Europe, for scientific conclusions as to the distinct advantage to be gained by the use of any particular breed of cows for infant feeding ; but clinically there appear to be well-established ideas to the effect that certain breeds of cows are better adapted than others for this purpose. Chemists have decided that the fats in the milk of the Channel Islands cows, and of one or two similar breeds found upon the Continent of Europe, contain a smaller proportion of the fixed and insoluble glycerids of the fatty acids and a larger proportion of the volatile and soluble glycerids than the milk of other breeds. As the volatile glycerids are more readily decomposed than the others and are richer in those elements which are found in the fat of nuts, it may be that this is the explanation of the less digestibility of these milks, both for the calf and for the baby. It seems probable that the best cow to employ as a foster-mother for the infant should belong to a breed that invariably and successfully raises its own young. Of these, the Durhams, Devons, Ayrshires, Holsteins, and similar hardy breeds are favorably distinguished. Then, also, the vigor of constitution of the breeds of cattle and their ready and perfect acclimatization are also potent reasons why these hardy breeds should be preferred to the more delicate ones. The milk of cows possessing a fat in the most perfect emulsion and with the smallest fat-globules is more easily digested than the milk of such cows as the Jersey breeds, in which fat-globules are large and easily "creamed" or separated from the body of the milk-serum. Besides the peculiarities in the fats already referred to, there are other differences in the milks of various breeds of cows which may influence their value as a food for infants. For example, the proportion of fats to proteids is of importance, especially when home modification is principally employed. Thus, the 3 per cent. proportion of fat of the milk of the Holstein (as compared with the 4 per cent. of fat of the better Durhams), when it appears in a milk containing over 4 per cent. of proteids, makes the latter more difficult to modify than does the milk containing the larger amount and richer quality of fat—*i. e.*, the milk of the Durham. The character in the emulsion of the fat in the milk of various breeds of cows is an important matter. The milk of the Holstein holds its fine fat-globules in a very perfect emulsion, and separa-

tion by gravity, which is the manner most commonly used at home, is slow and less perfect. On the other hand, when milk is used in the nursery in an unmodified condition, it is always safer to use a milk that has a perfect emulsion of the fats, so that when it is set aside for the raising of cream by gravity, the results are less varying and uncertain. The tendency to disease among the different breeds is slightly against the Jerseys and Guernseys, especially upon the Atlantic seaboard.

The Care of the Cow.—The cow whose milk is to be used for infant feeding should be cared for with this object only in view. Her stabling should be apart from other animals. Her food should be specially selected, and the water she drinks should be perfectly pure. She should be fed for the production of a digestible milk, and consequently the cow that makes the most butter from a given method of diet is not likely to be available for the feeding of a baby. A cow whose milk is intended for the use of infants should be groomed once or twice a day, protected from annoyances and frights, and generally treated as a member of the family. She needs sunlight, opportunity for open-air exercise, a fresh-air space of 1000 cubic feet, 80 square feet of floor space, and 12 square feet of window all to herself. Her bedding must be dry and clean—if possible, all dry mill-shavings or sawdust. She should be fed twice a day with good hay and grain, such as wheat-bran, ground oats, cornmeal, etc., which have been ground or treated only by mechanical processes. She should never be fed with any of the by-products of the brewery or glucose factory. A certain amount of some succulent food should be given her every day; thus, in the winter she should receive a measured quantity of sugar beets and carrots, and in summer an abundance of carefully grown, absolutely freshly cut green clover, alternating with green oats, green peas, green sweet corn, and the meadow grasses. She should never be permitted to range the ordinary pastures of the farms in the second half of the summer, as many of the prevalent weeds then growing are distinctly injurious. From the third to the eighth or ninth year of her life is perhaps the best period for the production of milk upon which to feed an infant. It is probable that she should bear a calf once a year. It has not, however, been shown as yet that the prolonged lactation of a castrated cow is injurious to the milk intended for infant feeding. The milk should not be used until it is quite free from colostrum, nor should it be used in any advanced stage of gestation. It is probable that the early period in a cow may render the milk for that day injurious to the infant, although in large herds

it is probable that this occurrence may have no practical bearing on the use of the milk, but this word of caution is necessary if the infant is to be fed from the milk of a single cow. The milk from cows used for infant feeding should be weighed accurately both morning and night, and a difference of a single pound at milking is probably an evidence that the cow is out of sorts. This is one of the best guides for the inexperienced on this question. The cow for infant's use should have the constant supervision of a veterinarian, because perfect health in her is absolutely essential to the well-being of the infant.

The Care of the Milk.—The milker's hands, arms, and fingernails before beginning work should be well scrubbed with hot water and soap for five minutes and rinsed in running water. They should then be scrubbed in a solution of borax, glycerin, and water, or with a small quantity of alcohol. This should be done before each milking. The pail in which the milk is received should be absolutely clean and sterilized with boiling water or live steam. The milker should dress in a freshly boiled and rough-dried suit of cotton cloth, or, as is the custom with very careful dairymen, the milker's clothes should be sterilized in a closet in which circulates live steam and which is built expressly for the purpose. The milk, as soon as drawn and while still hot, should be filtered through sterile surgical cotton, then immediately cooled to a temperature below 50° F. (10° C.), after which it is put in sterilized glass jars and kept in a clean, cold place until it is wanted for use. The milkers should be healthy men, living in healthy houses, and should be intelligent enough to understand the reasons and importance of perfect cleanliness. As precautionary measures are necessary against the well-known infectiousness of milk, especially contamination from outside sources, the water in which vessels are washed and rinsed should be isolated from all possibility of infection and all vessels and tools used in the dairy should be sterilized with live steam after rinsing. All manipulation of the milk should be done in a place separated entirely from the barn and in which the atmosphere is kept free from dust and odors.

SUPERVISION OF THE PRODUCTION OF MILK BY BOARDS OF HEALTH.

The majority of the States of the Union have, through their State boards of health, given much attention to improvement in the milk-supply, and in a general way this authority is exercised

in two principal directions: first, in the stamping out of certain infectious diseases prevalent among cows, and second, in inducing the better management of barns and dairies. The rarer and more serious diseases of the bovine race have been thoroughly handled by most of the State boards, so that at present there is little danger from pleuropneumonia or from anthrax. A good deal of attention is now given by the State to tuberculosis in cattle, and by the employment of tuberculin as a diagnostic agent in skilled hands this disease may be so reduced that the danger of harm resulting from it is at a minimum. In cities of considerable size a standard of milk quality as to solid contents is demanded of dairymen, from 12 to 13 per cent. of solids being required to constitute a legal milk, while in some cities the percentage of fat is also defined, the requirements being not less than 3 per cent. Precise scientific public control of the milk products is as yet unknown, and only the grosser forms of contamination and adulteration are at present regulated by law. It is left to the consumer to decide whether or not a milk is too old, too sour, or too dirty to be employed. The sources of contamination of milk are many and varied in number, and it may be said that a larger number of bacteria to the cubic centimeter can be found in milk sold in the poor districts of many of our cities than can be found in the sewerage of the same city. A fresh milk often contains 20,000 bacteria to the cubic centimeter, and in an old specimen that has been exposed, from 2,000,000 to 100,000,000 to the cubic centimeter may be found. This contamination arises not only from bacteria, which may be considered natural to milk and which may be comparatively harmless to adults, but also from bacteria which ought to be foreign to milk but are not. These more poisonous forms of micro-organisms are generally hurtful to both adults and children, while it is safe to say that all bacteria in milk are harmful, if not indeed dangerous, to infants. Milk should be kept free from the fecal discharges of the cow, as it is always impossible to say what varieties of bacteria may be present at any given time in cow manure, and it is certain that at times very dangerous species are passed by the animal. The pathogenic bacteria, those of such diseases as anthrax, pleuropneumonia, tuberculosis, sepsis of the udder, diphtheria, and other specific diseases of the cow, may be carried in milk to man; and the bacteria of a number of the diseases peculiar to man, such as typhoid fever and cholera infantum, may, through the carelessness of the milkers, be carried from man to man by the vessels in which the milk is kept or by the milk itself.

Certified Milk.—A movement originating in a committee of the County Medical Society of Newark, N. J., under the chairmanship of Dr. Coit, of Newark, has resulted in the production of a very superior milk, known as certified milk. The dairies supplying the milk are subjected to a strict supervision, and, in the main, careful work has been done during the past four years. Every thirty days a committee of physicians visits these farms and certifies to the general condition of the dairies. Certificates from a veterinary surgeon in good standing, from one of the most eminent chemists, and from a well-known pathologist are obtained and distributed to all the physicians in the district. This milk has already found its way into over 500 families, and the demand exceeds the supply. This would be the case in many other localities, if only the enterprise was understood and appreciated.

STERILIZATION AND PASTEURIZATION.

Various methods have been employed to maintain the nutritive properties of milk and at the same time destroy pathogenic bacteria. For this purpose heat has most generally been used: either raising the temperature of the milk above the boiling-point and maintaining it there for from twenty to thirty minutes, or quickly raising it to near boiling for from eight to ten minutes. The former is known as sterilization of milk and the latter as Pasteurization.

Sterilization.—As the milk comes from the cow it is a sterile fluid, but this condition of purity can only be maintained for a very short time, and for practical purposes the milk as delivered to our houses has passed through so many hands and has come in contact with so many vessels of at least doubtful cleanliness that some method of reducing the number of bacteria to at least the minimum must be arrived at by artificial means. In order to attain this result it was at one time the custom to raise the temperature of the milk by repeated heating to a point above the boiling-point of water. By this means all bacteria and their spores were destroyed, but the results obtained, as far as the nutrition of the child was concerned, were bad, largely by reason of the coagulation of the casein and the destruction of its nutritious principles. The fat-globules were also made to separate from the emulsion and run together.

Sterilized milk had, in some cases, a beneficial effect in the prevention of gastro-intestinal disease, but the failure of its nutritive qualities and its tendency to produce scurvy in young

children have caused us to seek some alternative which will destroy pathogenic bacteria and at the same time preserve the nutritive qualities of the milk.

Several implements have been devised for the sterilization of milk, probably one of the best having been invented by Starr. This apparatus consists of an oblong tin case provided with a neatly fitting cover and having a movable false bottom which is perforated and which stands a short distance above the fixed bottom. To the perforated false bottom is attached a framework capable of holding ten six-ounce nursing-bottles. On the outside of the case is a row of supports for holding the bottles while drying. A movable water-bath is hung at the side, this being for the purpose of warming the food at the time of administration. It is intended that ten nursing-bottles should be used, so that the entire day's supply of milk can be prepared at once. Each bottle is provided with a perforated rubber cork, which is in turn closed by a well-fitting glass stopper.

The day's supply of milk should be sterilized in the morning immediately after it has been served by the milkman. The directions for the process are as follows:

The bottles should first be washed with hot water, soap, and soda, and afterward rinsed in clean boiled water, and, after being thoroughly dried, they should be sterilized in the apparatus. Every bottle is to be filled with six fluidounces of milk, after which the perforated rubber corks should be inserted, but without the glass stopper. In place of both stopper and cork, a piece of absorbent cotton sufficient to close the mouth of the bottle may be used, as bacteria will not pass through this substance. The false bottom can now be removed and the filled bottles placed in the frame. The case should now be filled with water to the height of about two inches, and the false bottom containing the bottles replaced. The lid may now be adjusted and the sterilizer placed on the kitchen range. A few minutes after the milk has become thoroughly heated the glass stoppers are to be placed in the perforated corks. The water should be allowed to boil around the milk for twenty minutes, and at the end of this time the false bottom, with the bottles contained thereon, should be removed and the water poured off. The milk is now ready for use.

Other very efficient sterilizers are those devised by Arnold and Freeman. Milk prepared by the foregoing process will remain free from bacteria for several days.

A very useful sterilizing apparatus is one devised by Dr. Roland G. Freeman, of New York. In the construction of this the

inventor aims to do away with the differences in temperature that always occur between the milk at the bottom of the bottle and that at the top. The apparatus consists of two parts—a pail for the water and a receptacle for the bottles of milk. The pail is of tin and has a cover. A groove extends around the body of the pail to indicate the level to which it is to be filled with water, and there are supports inside for the receptacle which contains the bottles of milk to rest on. This receptacle is made of a series of zinc tubes fastened together, and this fits into the pail, so that the lower inch of the cylinders is immersed in water. The bottles of milk are placed in these cylinders. The receptacle has two sets of horizontal supports: the upper set, continuing around it, for use while the milk is being heated, and a lower set, to be used for raising the milk while it is cooling. The tubes of the receptacle are long enough to each contain one bottle holding from six to eight ounces. When the receptacle is elevated so that only the lower portion is in contact with the hot water, the inventor claims that the temperature of the milk is equalized throughout the whole bottle.

Pasteurization.—By this process the milk is kept for a period of from ten to twenty minutes at a temperature of from 160° to 170° F. (71.1° to 76.7° C.). While this process will not destroy all the bacteria present, yet such pathogenic organisms as the spores of tuberculosis, pneumonia, typhoid fever, etc., will be destroyed, and developed bacteria rendered inert.

Pasteurization may be accomplished by the use of any of the sterilizers before mentioned. As special appliances for this purpose are rather costly and somewhat complex, a much simpler one, known as the Woodbury sterilizer, has been devised. This consists of a light wire frame made somewhat in the shape of an old-fashioned dinner-caster and containing six bottles. These bottles are graduated in ounces and have a screw top like a preserving jar. In the center of the screw-top lid is a small opening covered by a cap, through which the steam escapes.

To use the apparatus the bottle should be filled with milk, and, after being placed in the wire frame, the whole apparatus is set in a vessel of boiling water, care being taken that the water in the vessel comes just about as high as the milk inside the jar. During the first part of the sterilization the small caps are left off so as to allow the steam to escape.

The advantages of this apparatus are its cheapness and simplicity; the disadvantage lies in the fact that the child can not nurse directly from the bottles because they are not of the proper shape and size, but the milk must be poured into a nursing-bottle,

thereby exposing it to contamination by the air. Besides this, the screw thread which is cut in the glass for the top to fit over offers a favorable lurking-place for septic material.

In families in which, for any reason, a sterilizing apparatus can not be obtained, the milk can be Pasteurized in the following simple way: A perfectly clean preserving jar or clean bottle containing the day's supply of milk mixture should be placed in a kettle of warm water. The water in the kettle should be raised to the boiling-point. A clean all-glass thermometer can be used for testing the temperature of the milk in the jar; this should be kept at 170° F. for from fifteen to twenty minutes. The jar should then be removed, tightly corked or stoppered, and placed on ice. During Pasteurization it is preferable that absorbent cotton be placed in the neck of the bottle; this will allow the steam to escape, and at the same time will prevent the entrance of bacteria. In some cases we have found it preferable to make up the milk mixture for one nursing at a time, and to Pasteurize it just before giving it to the child.

The shape and cleanliness of the nipple should receive careful attention. Probably the most satisfactory style of nipple is the one that has stood the test of years of use—namely, a nipple made of plain rubber and conic in shape. Another form has been devised, with a small perforated protrusion jutting off from the narrow constricted portion, the object of this being to allow air to pass in, so as to prevent the nipple from collapsing while the child is nursing. The nursing apparatus consisting of a perforated cork and rubber tube with a nipple on the end of it should never be used, as it is impossible to keep it clean no matter how carefully one may try. Such a nipple after a few days' use will be found swarming with bacteria along the entire inside of the apparatus.

After each nursing the nipple should be carefully scalded and washed in a strong solution of soda or borax, and kept soaking in a solution of boric acid and water.

MODIFIED MILK.

The object to be accomplished in modifying cow's milk or the milk of other animals is to change the proportions of the milk elements—fat, proteids, sugar, and salts—in such a manner as to make a food which will not only resemble human milk in the amount and relation of the milk elements, but will be perfectly assimilated by the infant. As cow's milk is so much more easily obtained than the milk of other animals and is in such

general use for infant feeding, it will be understood that in treating the subject of modified milk we mean modified cow's milk.

The reasons for changing the proportion of milk elements in cow's milk before it can be best adapted to the digestion of the human infant have been explained in full in a previous chapter, but, to repeat slightly, the amount of proteids is considerably greater in cow's than in human milk, while the proportion of fat and carbohydrates is about the same or somewhat smaller; consequently, if we dilute cow's milk with water in order to reduce the proportion of proteids to that of human milk, we reduce the other elements—fat and carbohydrates—far below what we require. Therefore fat must be added in the form of cream and carbohydrates in the form of sugar—usually sugar of milk—until the required proportion is reached.

It is generally considered, at the present time, that cow's milk so modified is the best artificial food for infants, its advantages being that it is easily obtainable, quite cheap, and capable of almost unlimited modification, thereby insuring a food which can be made to suit the digestion of any child.

When the home method is used, the feeding of a child on modified milk requires very little more labor on the mother's part than does the preparation of patent foods. When the infant is fed from a milk laboratory, the mother or nurse is put to absolutely no inconvenience except to warm the milk mixture before feeding it to the infant. Feeding a child on modified milk, whether from the laboratory or at home, requires, on the part of the physician, a careful study of the physiology of infantile digestion in general, and a close watch over the individual case in hand. Very few general rules can be made; every infant should be a law unto itself. From the giving of the first milk formula the infant must be constantly watched, weighed at regular intervals, its digestive functions studied, and when the slightest abnormality occurs in the stools, these should be examined to see wherein the food is at fault. If vomiting occur, a similar examination of the vomited matter must be made. When any element of the milk mixture is at fault, it should be changed, until a mixture is made which perfectly agrees with the child. Frequently the changing of one of the elements by a fraction of 1 per cent. will make the greatest possible difference in the digestibility of the milk mixture.

When a formula is at last constructed which suits the child's digestion, there is, at the present time, no other food except the healthy mother's milk which will assimilate so well and upon

which an infant can be fed for such a length of time and which is capable of so many combinations to suit the requirements of the child's advancing age as cow's milk suitably modified. Although, doubtless, many children have thriven on pure cow's milk and even on patent foods, this is not the rule with the greatest number of children. Pure cow's milk is apt to produce symptoms of proteid indigestion, and the patent foods, composed chiefly of starch, dextrin, or maltose, even when mixed with milk, tend to produce rickets or scurvy. They may in some cases be used for a short time with benefit, but their long continuance is to be discouraged.

Infants may be fed on milk modified in milk laboratories or at home, but in either case the physician should have personal supervision over the matter and the milk mixtures should be ordered or changed by his prescription only. He should see his patient sufficiently often to watch its progress, and should keep careful notes with copies of all milk formulas given, and the symptoms following. All changes in weight must be carefully noticed. It is necessary that he should have a sufficient knowledge of the subject of modern infant feeding to be able to calculate the percentages of fat, proteids, sugar, and the degree of alkalinity of the milk formulas that he uses, and to translate them into the common measures of drams and ounces of cream, milk, sugar, etc.; especially is this the case if the milk is to be modified at home.

Milk Laboratories.—Of late years reliable milk laboratories have been established in several of the principal cities of the country. In 1891 Mr. G. E. Gordon established in Boston what was known as the Walker-Gordon Milk Laboratory. Since then branches of this house have been opened in New York, Philadelphia, Baltimore, Montreal, and Chicago. These laboratories furnish milk which is modified upon a physician's prescription, in exactly the same manner as an apothecary dispenses drugs. Briefly speaking, the principal points of superiority claimed for this method are as follows: 1. The primal milk-supply is under the supervision of the laboratories, and the cows are selected, cared for, and fed with but a single purpose in view—namely, the production of a milk suitable for infant's use. 2. The freshness of the milk is not impaired by the process of preparation. 3. In these laboratories milk is modified exactly and scientifically. Every infant has its own milk freshly prepared, the formula being made to suit its particular digestion, the fats, sugars, and proteids being prescribed with this object in view. 4. The milk is modified and sold only upon a physician's prescription, so that over-

anxious mothers and nurses can make no mistakes as to the quantity and quality of the milk preparation.

The greatest advantages in this method are the accuracy of the composition of the food and its careful sterilization or Pasteurization before its delivery. The principal disadvantages are that it is somewhat expensive and, at the present time, such milk is hard to obtain within more than a hundred miles from any of our large cities.

In compounding modified milk the directors of the laboratories consider the milk only in the light of its component parts. In modifying milk the following articles are used: (1) Cream which contains 16 per cent. of fat; (2) separated milk from which the fat has been removed by a centrifugal machine; (3) a standard solution of sugar of milk of a strength of 20 per cent. It is possible, by varying these elements in different proportions, to produce almost any degree of modification. In writing a prescription for a modified milk the physician fills out a regular prescription form, furnished by the laboratory, using any percentages of fat, sugar, and proteids and the percentage of alkalinity that may be desired, giving the quantity for each feeding and the number of feedings in the twenty-four hours. The laboratory furnishes a daily supply in the bottles from which the child is to be fed.

SPECIMEN MILK PRESCRIPTION OF THE WALKER-GORDON LABORATORY.

Per cent.	
Fat, ... 4	*Reaction*, ... Slightly alkaline
Milk-sugar, ... 7	*Number of feedings*, . . . 7
Proteids, ... 1.5	*Amount at each feeding*, . 135 c.c. (4½ oz.)
Mineral matter.	*Heated for*, ... Twenty minutes
Lime-water.	*Heated at*, ... 167° F. (75° C.).
Special directions.	*Remarks.*
	Infant's age, ... Four months
For whom ordered.	Infant's weight, ... 14 pounds.
	Signature,
Date.	*M.D.*

When it is necessary to wean the child or partially to substitute cow's milk in place of breast milk, an analysis of the latter should first be made. If the mother's milk agreed with the infant before it was weaned, a modified milk, the proportions of which are similar to the mother's milk, should be ordered by the physician from the laboratory. Quite frequently, however,

it will be necessary to start the infant on a modification in which the proportions of proteids and fats are somewhat lower than they were in the mother's milk previous to weaning, the reason for this being that the proteid of cow's milk is more difficult for the infant to digest than is the same element in human milk. The amount of milk to be given at each feeding will depend in a great measure on the weight of the child and its gastric capacity as represented by its age.

The following table will show the total quantity of food and the relative proportions of fat, sugar, and proteid which a healthy infant can take from birth until the eighteenth month:

Age.	Fat.	Sugar.	Proteids.	Daily Quantity.	
	Per cent.	Per cent.	Per cent.	Ounces.	Grams.
First and second day, ...		5		4–8	125–250
Third to seventh day, ...	2	6	0.6	10–15	310–460
Two to four weeks, ...	2.5	6	0.8	20–30	620–930
One to three months, ...	3	6	1	22–36	680–1110
Three to four months, ...	3.5	6	1.25	28–38	870–1180
Four to six months, ...	4	6	1.5	32–38	990–1180
Six to nine months, ...	4	7	2	32–42	1050–1300
Nine to twelve months, ...	4	6	2.5	38–45	1180–1400
Twelve to fifteen months, . .	4	5	3	40–50	1240–1550
Fifteen to eighteen months, . .	4	5	3.5	45–50	1400–1550
Eighteen months, ...	3.5	4.3	4	45–50	1400–1550

Ssnitkin's investigations show that $\frac{1}{100}$ of the initial weight plus one gram for each day of life should be taken as the figure with which to begin the calculation of the relative weight of a child to its gastric capacity.

Illustration of Ssnitkin's rule to aid in adjusting the food to especially difficult cases in the first thirty days:

Initial Weight.	Amount at Each Feeding.		
	Early Days.	At Fifteen Days.	At Thirty Days.
3000 grams, . .	30 grams (about 1 oz.).	30 + 15 = 45 grams (about 1½ oz.).	30 + 30 = 60 grams (about 2 oz.).
4500 grams, . .	45 grams (about 1½ oz.).	45 + 15 = 60 grams (about 2 oz.).	45 + 30 = 75 grams (about 2½ oz.).
6000 grams, . .	60 grams (about 2 oz.).	60 + 15 = 75 grams (about 2½ oz.).	60 + 30 = 90 grams (about 3 oz.).

When the child's digestion is weak, the proportions of the various constituents of the milk, especially the fats and proteids, may have to be changed several times before a modification can

be made which will be suitable for permanent use. As the child's digestive apparatus becomes stronger the proportions of proteids and fats may be gradually increased until the following proportions are obtained:

Fat,	3 per cent.
Sugar,	6 "
Proteids,	1 "

The preparation should be made slightly alkaline and heated to a temperature of 167° F. (75° C.). This formula will represent about the average constitution of human milk with a rather low percentage of proteids. If the infant seems to thrive on this and continues gradually to gain in weight, the proportion of fats and proteids may be slowly raised until, by the time it has reached the tenth or eleventh month of life, it is taking pure cow's milk. This should have enough lime-water added to make it somewhat alkaline in reaction, and should be heated to about 167° F. (75° C.). The weight of the infant and the state of its digestion are points which must guide us as to whether any particular modification is doing well. There are certain general symptoms in the infant which will guide our knowledge as to whether or not the milk is doing all that is required of it. When the percentage of *fat* is *too high*, the child will have frequent regurgitations of food in small quantities, these usually appearing an hour or two after feeding. The bowel movements are frequent and sometimes of normal appearance, but in some cases they may contain small round lumps resembling casein, but which are really composed of fat. Not infrequently, also, the child will give evidence of suffering from colic.

When the child is receiving too *small an amount of fat*, the bowels are constipated and the stools dry and hard. When the amount of *sugar* is *in excess*, there will be frequent eructations of gas from the stomach and regurgitation of small quantities of milk. Colic will also be present, and the stools are apt to be green, thin, and very acid, often causing severe irritation of the buttocks. In cases where the percentage of *sugar* is *too low*, the gain in weight is slow or absolute loss of flesh may be noticed. When the proportion of *proteids* is *too high*, the infant cries a great deal because of colic, and constipation is the rule, although occasionally there may be short attacks of diarrhea, the stools containing masses of curd. Vomiting is frequent, the vomited matter containing curds of varying size. *Imperfect digestion* of *proteids* may cause much the same symptoms as when this element is in excess, as, indeed, it really is too great in proportion

to the digestive capacity. A *general excess of food* may produce very much the same symptoms as when the individual elements are in excess. Holt has summarized the indications for modification of the various constituents of milk as follows:

If the child is not gaining in weight without special signs of indigestion, increase the proportions of all the ingredients. If habitual colic is present, diminish the proteids. If vomiting appear very soon after feeding, reduce the quantity of food given. For the regurgitation of sour masses of food reduce the fat and sometimes the proteids. For obstinate constipation increase both fats and proteids.

Home Modification.—The question of the modification of milk at home is one of much importance and interest. By even a slight study of this subject the practitioner will often be able to restore to health many infants who do not need drugs to help them, and who are not sick, but starving. It is not necessary that a child should be without food to starve; many children perish every year while being given plenty of nourishment, as far as quantity goes, the composition of the food being such that it is either not digested at all or only partially digested, the most of it remaining in the stomach and intestines subject to fermentation and later setting up acute or subacute forms of fermentative diarrhea. At first sight the method for the scientific modification of milk such as has been placed before the profession by the careful labors of Rotch and others is, so far as the technic goes, a rather difficult one, and yet a little study of the subject will show it to be not so perplexing as at first sight; even the busiest of practitioners can, in a short time, obtain a knowledge of infant feeding which will enable him to instruct the mother as to the needs of the patient, and to make a food much better because nearer in composition to the child's natural diet than any of the proprietary foods so commonly used.

There are several methods by which milk can be modified at home, none of them being very complex. We give, however, only those which are the simplest and best adapted for ordinary use:

Holt's Method.—This plan of modification, which is somewhat more complicated than one which will be given later, is as follows:

It is essential to have on hand the elements from which the desired formulas can be compounded. *First*, for the fat it is necessary to have one of the following preparations of cream: (1) a 12 per cent. cream—*i. e.*, one that contains 12 per cent. of fat. This may be obtained by using equal parts of the ordinary

20 per cent. centrifugal cream and plain milk; or (2) by using two parts of ordinary skimmed or gravity cream (such as would be produced by allowing milk to set overnight) containing 16 per cent. of fat mixed with one part of plain milk. *Second*, an 8 per cent. cream. This may be obtained by using (1) one part of 20 per cent. centrifugal cream and three parts of plain milk; or (2) by using one part of gravity cream and two parts of plain milk; or (3) using the top layer from milk which has been standing for five or six hours.

The following solutions of sugar: A *5 per cent.* solution, made by dissolving 1 ounce of milk-sugar in 20 ounces of water, or one even tablespoonful in 7½ ounces of water (one even tablespoonful represents three drams). A *6 per cent.* solution: one ounce of milk-sugar is dissolved in 16½ ounces of water, or one even tablespoonful in 6½ ounces of water. A *7 per cent.* sugar solution: one ounce of sugar is dissolved in 14 ounces of water, or one even tablespoonful in 5½ ounces of water. An *8 per cent.* sugar solution: one ounce is dissolved in 12½ ounces of water, or one even tablespoonful in 4½ ounces of water. A *10 per cent.* sugar solution: twice the strength of a 5 per cent. solution.

Other Articles Needed.—Some freshly prepared lime-water, some filtered water which has been boiled for fifteen minutes, several nursing-bottles, preferably of cylindric shape and graduated to ounces and drams, plain rubber nipples, and some absorbent cotton. The method of preparing the milk is as follows: (1) To decide the proportion of each of the elements to be used; (2) the number of feedings in the twenty-four hours; (3) the quantity for each feeding. Suppose we wish the formula to contain 3 per cent. of fat, 6 per cent. of sugar, and 1 per cent. of proteids, and we require nine feedings of four ounces each: it is necessary to prepare thirty-six ounces of food. In order to make up this formula the following proportions of the various elements are necessary:

Centrifugal cream, .	4½ ounces	or	Skimmed cream, . . 6 ounces
Plain milk, ...	4½ "		Plain milk, . . . 3 "
Milk-sugar, . . .	2 "	or	5½ even tablespoonfuls
Boiled water, . .	25½ "	or	Boiling water, . . . 27 "
Lime-water, . . .	1½ "		Bicarbonate of soda, . 36 grains.

The sugar is to be dissolved in boiling water and filtered through cotton and allowed to cool partially. The milk and cream should next be added and the whole mixed in a pitcher, after which the alkaline liquid (either lime-water or a solution of bicarbonate of soda) or plain sterilized water is to be added. The

mixture is now to be divided into nine bottles, the mouths of which should be stoppered with cotton. The bottles should next be placed in a sterilizer for Pasteurization or sterilization, according to directions. Otherwise they should be cooled by standing in cold water for fifteen minutes, during which time the temperature of the water is to be reduced by the addition of ice. The food should be kept in an ice-chest until time for use, when it should be heated slightly by placing in warm water. The principal fault to be found with this method is the variety of proportion in the ingredients used. To be able to combine these in definite ratio so as to make an accurately compounded milk formula requires no little study and calculation.

Rotch's Method.—Rotch has devised a much simpler method for the modification of milk at home. The articles required are the following: A wide-mouthed glass jar holding one quart, a siphon of glass tubing, ¼ to ½ of an inch in diameter, and bent so that the end from which the milk is to flow is six inches longer than that which is inserted in the jar.

One quart of fresh milk from a herd of cows is thoroughly strained and put into the jar, which is kept open for fifteen minutes in order to allow it to cool. The jar is then sealed tightly, and placed in a vessel containing iced water and salt, in the proportion of a teaspoonful of salt to a quart of water. This is set in a cool place for six hours. At the end of this period siphon out three-fourths of the milk from the bottom of the jar into a clean vessel. The mouth must not be used to start the flow of the milk through the siphon, but the latter must be filled with clean boiled water, the longer end closed with the finger and the siphon inverted, the shorter end being placed in the milk. When the finger is withdrawn, the water followed by the milk will run out of the longer division.

The materials necessary for preparing the milk mixture are the following:

1. The milk which has been siphoned from the jar.
2. The cream which remains in the jar and which contains 10 per cent. of fat.
3. Milk-sugar. This may be purchased by the pound and divided by the druggist into packages, each containing 3ss drams 200 grams), or a measure containing 3ss drams may be made.
4. Some lime-water.
5. Some well-boiled and filtered drinking-water.

The milk-sugar is first to be dissolved in the water and the other ingredients then added.

The following tables are prepared by these rules:

1. Low Percentage of Fat and Proteids.

Proteids,	0.25	Cream,	½ ounce
Fat,	0.25	Milk,	1 "
Sugar,	4	Lime-water,	1 "
Lime-water,	5	Water,	17½ ounces
			20 ounces
		Milk-sugar,	2 measures (or 6¾ drams).

2. Low Percentage of Fats and Proteids.

Proteids,	0.75	Cream,	2 ounces
Fat,	1	Milk,	2 "
Sugar,	5	Lime-water,	1 ounce
Lime-water,	5	Water,	15 ounces
			20 ounces
		Milk-sugar,	2 measures.

3. For Weaning.

Proteids,	3.5	Cream,	8 ounces
Fat,	4	Milk,	12 "
Sugar,	4.5		
			20 ounces

4. For Weaning.

Proteids,	3.25	Cream,	8 ounces
Fat,	4	Milk,	8 "
Sugar,	5	Lime-water,	1 ounce
Lime-water,	5	Water,	3 ounces
			20 ounces
		Milk-sugar,	⅞ measure.

5. For Weaning.

Proteids,	3	Cream,	8 ounces
Fat,	4	Milk,	7½ "
Sugar,	5	Lime-water,	1 ounce
Lime-water,	5	Water,	3½ ounces
			20 ounces
		Milk-sugar,	1 measure.

6.

Proteids,	3	Cream,	8 ounces
Fat,	4	Milk,	7½ "
Sugar,	7	Lime-water,	1 ounce
Lime-water,	5	Water,	3½ ounces
			20 ounces
		Milk-sugar,	2 measures.

		7.	
Proteids,	1	Cream,	4 ounces
Fat,	2	Milk,	1½ "
Sugar,	5.5	Lime-water,	1 ounce
Lime-water,	5	Water,	13½ ounces
			20 ounces
		Milk-sugar,	2¼ measures.
		8.	
Proteids,	1	Cream,	5 ounces
Fat,	2.5	Milk,	None
Sugar,	6	Lime-water,	1 ounce
Lime-water,	5	Water,	14 ounces
			20 ounces
		Milk-sugar,	2½ measures.
		9.	
Proteids,	1.5	Cream,	7 ounces
Fat,	3.5	Milk,	1 ounce
Sugar,	6.5	Lime-water,	1 "
Lime-water,	5	Water,	11 ounces
			20 ounces
		Milk-sugar,	2½ measures.
		10.	
Proteids,	1.5	Cream,	8 ounces
Fat,	4	Milk,	None
Sugar,	7	Lime-water,	1 ounce
Lime-water,	5	Water,	11 ounces
			20 ounces
		Milk-sugar,	2¼ measures.
		11.	
Proteids,	2	Cream,	8 ounces
Fat,	4	Milk,	2½ "
Sugar,	7	Lime-water,	1 ounce
Lime-water,	5	Water,	8½ ounces
			20 ounces
		Milk-sugar,	2½ measures.
		12.	
Proteids,	2.5	Cream,	8 ounces
Fat,	4	Milk,	5 "
Sugar,	7	Lime-water,	1 ounce
Lime-water,	5	Water,	6 ounces
			20 ounces
		Milk-sugar,	2¼ measures.

In some cases barley-water may be used with advantage in place of lime-water or in combination with it. The special indications for this will be mentioned later on.

Of late much attention has been paid by those especially interested in infant feeding by modified milk to the simplification of the methods of calculating the percentages of the elements

which constitute a milk mixture. Until recently the methods used in the calculation of these formulas were of so complex a nature and involved so large an amount of work that the average practitioner had not the time nor patience to give the subject the attention it deserved. The matter is also made more complex because of the difficulty in getting a milk or cream of a standard quality on which to base our calculations. However, as the study of the subject continues and our knowledge increases, simpler methods will doubtless be invented. Out of the many methods used at the present time, we have endeavored to describe only those which have stood the test of practical experience.

Westcott's method of calculating the proportions of cream, milk, and milk-sugar in percentage mixtures is probably the most accurate method which has been devised; it is capable of wide application.* In the calculation the following symbols are used:

C = Cream in ounces.
M = Milk in ounces.
Q = Total quantity of mixture in ounces.
F = Desired fat percentage.
P = Desired proteid percentage.
S = Desired sugar percentage.
L = Ounces of dry sugar of milk to be added.

In his calculations he uses practically the Walker-Gordon analyses, which are the same as those given by Holt and Rotch and are here copied from Westcott:

M, ...	4	per cent.	fat,	4	per cent.	proteids,	4.4	per cent.	sugar.
C (12 per cent.),	12	"	"	3.8	"	"	4.2	"	"
C (16 per cent.),	16	"	"	3.6	"	"	4	"	"

The quantities of cream, milk, and dry milk-sugar required to make any desired quantity of a mixture containing chosen percentages of fat, proteid, and sugar can be rapidly calculated by substituting these known values in the following formulas and working out the indicated mathematical processes to find values for C, M, and L:

For a combination of 12 per cent. cream and 4 per cent. (whole) milk the formulas are:

$$C = \frac{Q\,(F-P)}{8.2}$$

$$M = \frac{QF}{4} - 3\,C$$

$$L = \frac{QS - 4.30\,(C + M)}{100}.$$

*See "International Clinics," Oct., 1900. "The Scientific Modification of Milk," by Dr. Thompson S. Westcott.

For a combination of 16 per cent. cream and 4 per cent. (whole) milk the formulas are:

$$C = \frac{Q\,(F-P)}{12.4}$$

$$M = \frac{QF}{4} - 4\,C$$

$$L = \frac{QS - 4.20\,(C + M)}{100}.$$

If 20 per cent. cream is used, the denominator of the fraction giving the value of C should be 16.8, and 5 instead of 4 should be used as coefficient of C in the equation for M.

In the sugar formulas 4.3 and 4.2 represent the mean between 4.4 and 4.2, and between 4.4 and 4, respectively, the sugar percentages of the cream and milk in each case, the mean value being used for the sake of simplicity.

There are a few exceptions to the formulas previously given which, as quoted from Westcott, are as follows: "In proteid percentages less than 1, 16, or even 32 per cent. cream may be required for the higher fat values; in proteid values from 1 to 1.25, 16 per cent. cream is required for fat values from 3.25 to 4 for the lower, and from 3.75 to 4.00 for the higher, of these proteid percentages. Also for the higher proteids (2.25 to 4) skimmed milk instead of cream would be required for fat percentages lower than the proteid percentage. In practice, however, it is extremely rare to use a fat percentage lower than the proteid, so that this method will be found to give very satisfactory working results."

After the amounts of cream, milk, and sugar have been calculated and measured, the quantity should be made up with boiled drinking-water, barley-water, or other suitable diluent.

Example.—Required a forty-ounce mixture containing:

			Result.	
Fat	3 per cent.	Cream	7.3	fluidounces
Sugar	5 "	Milk	8.1	"
Proteids	1.5 "	Lime-water	2	"
Lime-water	5 "	Water	22.6	"
		Sugar of milk	1.34	ounces.

$$C\ (12\text{ per cent.}) = \frac{40 \times 3 - 1.50)}{8.2} = \frac{60}{8.2} = 7.3 \text{ fluidounces.}$$

$$M = \frac{40 \times 3}{4} - 3 \times 7.3 = 30 - 21.9 = 8.1 \text{ fluidounces.}$$

$$\text{Lime-water} = 40 \times 0.05 = 2 \text{ fluidounces.}$$

$$\text{Water} = 40 - (7.3 + 8.1 + 2) = 22.6 \text{ fluidounces.}$$

$$L = \frac{40 \times 5 - 4.3\,(7.3 + 8.1)}{100} = \frac{200 - 66.22}{100} = 1.34 \text{ ounces.}$$

Baner ("New York Medical Journal," March 12, 1898) recommends a series of practical rules for calculating the amount of each milk element. These rules are based on the understanding that good cow's milk contains an average of 4 per cent. fat and 4 per cent. proteids. Cream is regarded as a superfatted milk containing practically the same amount of proteids as milk itself. So long as the cream is fresh and clean, we may use either a 12 per cent. cream, obtained by allowing milk to stand over in a tall vessel for six hours and removing the upper fifth; a 16 per cent. cream, obtained by skimming, or a 20 per cent. cream, obtained by the use of a separator. For convenience in explanation the 16 per cent. gravity cream is employed in the following rules, but only a slight change is necessary if cream of another percentage is used. Having decided on the exact percentage deemed most suitable for the case and the number of ounces required for the day's feeding, the physician will proceed to estimate the amount of cream to be used in the mixture according to the following rule:

Subtract the proteid percentage from the fat percentage and multiply the remainder by the total number of ounces in the mixture divided by 12. This gives the total number of ounces of cream. To estimate the quantity of milk needed, multiply the quantity of the mixture by the proteid percentage and divide by 4. This gives the total quantity of milk and cream. Subtract from this the amount of cream, and the remainder will be the amount of milk required. It is hardly necessary to estimate the water, as it is self-evident that the entire mixture less the milk and cream will be water. To obtain the amount of dry milk-sugar, multiply the difference between the sugar and proteid percentages by the quantity of the mixture and divide by 100. Baner's formulas for determining the amounts of cream, milk, water, and dry milk-sugar required to make any desired quantity or mixture to contain given percentages are as follows:

Given:

Quantity desired (in ounces) . . . = Q
Desired percentage of fat . . . . = F
Desired percentage of sugar . . . = S
Desired percentage of proteids . . = P

To find (in ounces):

$$\text{Cream (16 per cent.)} = \frac{Q}{12} \times (F - P)$$

$$\text{Milk} \quad \ldots\ldots = \frac{Q \times P}{4} - C$$

$$\text{Water} \quad \ldots\ldots = Q - (C + M)$$

$$\text{Dry milk-sugar} \quad \ldots = \frac{(S - P) \times Q}{100}.$$

If 20 per cent. centrifugal cream is used, the denominator of the cream formula will be 16 instead of 12. If 12 per cent. cream is used, it will be 8 instead of 12.

Examples.—Suppose a forty-ounce mixture is required containing fat 4 per cent., sugar 7 per cent., and proteids 2 per cent.:

$$\text{Cream} \;.\;. = \frac{40}{12} \times 2 = 6\tfrac{2}{3} \text{ ounces}$$

$$\text{Milk} \;.\;. = \frac{40 \times 2}{4} - 6\tfrac{2}{3} \text{ ounces} = 13\tfrac{1}{3} \text{ ounces}$$

$$\text{Water} \;.\;. = 40 - 20 = 20 \text{ ounces}$$

$$\text{Sugar} \;.\;. = \frac{5 \times 40}{100} = 2 \text{ ounces.}$$

To find the quantities of each element in a twenty-four ounce mixture containing fat 4 per cent., sugar 6 per cent., and proteids 15 per cent.:

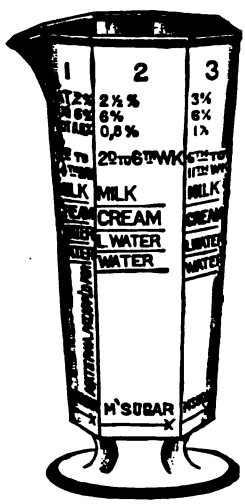


FIG. 18.—ESTRAN'S MATERNA.

$$\text{Cream} \;.\;. = \frac{24}{12} \times 2.5 = 5 \text{ ounces}$$

$$\text{Milk} \;.\;. = \frac{24 \times 1.5}{4} - 5 = 4 \text{ ounces}$$

$$\text{Water} \;.\;. = 24 - 9 = 15 \text{ ounces}$$

$$\text{Milk-sugar} = \frac{4.5 \times 24}{100} = 1.8 \text{ ounces.}$$

The usefulness of this method depends upon the ease with which odd amounts of a mixture can be calculated; on the other hand, it must be remembered that a very high percentage of fat with a low proteid percentage can not be made from a 12, 16, or even a 20 per cent. cream.

Other practical methods for the home modification of milk have been suggested by Morse,* Townsend,† and others. The methods of Morse and Townsend are very similar, but Townsend's is perhaps the simpler. It is based on the use of the top quarter of milk that has stood for six hours, the percentages being: fat, 10 per cent.; proteid, 4 per cent.; sugar, 4 per cent. The rule to be remembered is as follows: Each ounce of 10 per cent. cream in a twenty-ounce mixture represents 0.5 per cent. of fat, 0.2 per cent. of proteids, and 0.2 per cent. of sugar, and each even tablespoonful of sugar of milk represents 2 per cent. In a mixture containing 4 per cent. of fat the highest proteid obtain-

* "Annals of Gyn. and Pediatrics," April, 1899.
† "Boston Med. and Surg. Jour.," March 23, 1899.

able is 1.6 per cent.; the proteid may then be raised by taking more of the milk than the top quarter, or by adding whole milk, which contains fat, or the bottom quarter, which is nearly free from fat.

One of the easiest methods of modifying milk at home is by the use of the Materna. This is a large graduated glass beaker having on its outer surface seven panels, one graduated in ounces and the other six graduated in the following manner:

1 3D TO 14TH DAY. Fat, 2 % Proteids, 0.6 % Sugar, 6 %	2 2D TO 6TH WEEK. Fats, 2.5 % Proteids, 0.8 % Sugar, 6 %	3 6TH TO 11TH WEEK. Fats, 3 % Proteids, 1 % Sugar, 6 %	4 11TH WEEK TO 5TH MONTH. Fats, 3.5 % Proteids, 1.5 % Sugar, 7 %	5 5TH TO 9TH MONTH. Fats, 4 % Proteids, 2 % Sugar, 7 %	6 9TH TO 12TH MONTH. Fats, 3.5 % Proteids, 2.5 % Sugar, 3.5 %
Milk.	Milk.	Milk.	Milk.	Milk.	Milk.
Cream.	Cream.	Cream.	Cream.	Cream.	Cream.
Lime-water.	Lime-water.	Lime-water.	Lime-water.	Lime-water.	Barley Gruel.
Water.	Water.	Water.	Water.	Water.	Grape-sugar.
Milk-sugar.	Milk-sugar.	Milk-sugar.	Milk-sugar.	Milk-sugar.	
——×	——×	——×	——×	——×	

Gaertner, in his "Fettmilch" or mother's milk, aims to reduce the excess of casein in cow's milk by the use of the following method: A separator, known as the Pfanhauser centrifuge, making 4800 revolutions a minute is employed. The machine is filled with equal parts of fresh cow's milk and sterilized water. The speed of the centrifuge is regulated so as to separate the mixture into (1) creamy fatty milk and (2) skimmed milk. The two portions are led off by as many openings. An analysis of each of these portions shows that the creamy milk has the same quantity of fat as is found in human milk. About 2 per cent. of the casein is contained in the skimmed milk, and the balance, 1.7 per cent., remains in the creamy milk. In order to bring up the proportion of sugar to that found in human milk, about three or four grams of milk-sugar are added to every 100 c.c. of the fat milk. It is claimed that the fat milk has the advantage over diluted milk of

having a higher percentage of fat, while the curd is rendered more digestible. When the digestion is very weak, it is sometimes necessary to predigest the milk, wholly or partially, before the child's stomach will retain it. Escherich has laid down the following rules for the amount and frequency with which this food may be given: During each twenty-four hours children two weeks old require 16 ounces in nine meals; from two to four weeks old, 25 ounces in eight meals; from four to eight weeks old, 33 ounces in eight meals. Children from three to four months old require 42 ounces in eight meals; from five to six months old, 50 ounces in seven meals.

Backhaus' Kindermilch.—The results of this method of infant feeding have been reported by Kolisko and others. The milk is taken from a selected herd, strict cleanliness being observed, and the cream separated by centrifugation. The skimmed milk is then mixed with rennet, trypsin, and sodium carbonate, and kept at a temperature of 40° C. (104° F.) for half an hour, the trypsin having by this time converted 30 per cent. of the casein into a soluble form of albumin, the remainder being precipitated by the rennet. Steam is then introduced, and the temperature raised to 80° C. (176° F.) for five minutes. The mixture is then strained through cloths, after which one-half the volume of water, one-fourth the volume of cream, and the necessary amount of milk-sugar are added. It is then divided into bottles containing 125 c.c. (4 ounces), and sterilized and sealed. The Kindermilch is made in three strengths, as follows:

	I.	II.	III.
Fat,	3.1	3.2	3.3
Milk-sugar,	6	5.4	4.8
Casein,	0.6	1.8	3
Albumin,	1	0.3	0.5
Salts,	0.4	0.4	0.7

Various other methods, such as the addition of albumose or egg-albumen, have also been recommended.

Predigestion.—Several methods of doing this have been resorted to. Probably the most successful consists in the use of an amount of extract of pancreatin relatively small in proportion to the amount of milk. This is used simply to start the process of predigestion, the process being then arrested by quickly raising the temperature of the milk to a degree sufficient to destroy the ferment. By this method the milk shows less readiness to curdle by the addition of rennet or an acid, and the curd thrown down is in smaller particles and softer than that found in fresh cow's milk. It should be borne in mind in feeding a child on

predigested food that while this form of nourishment acts very well for a short time in children with weak digestion, yet a long-continued course of such foods will predispose the patient to rickets or scurvy, particularly if the milk has been subjected to the longer method of sterilization.

DIET OF CHILDREN FROM THE SIXTH TO THE EIGHTEENTH MONTH.

During the first year of life the infant's food should be milk, preferably milk from the mother's breast, or that failing, the best substitute is cow's milk modified in the manner described. If the latter method has been used, it will be found that as the child advances in age and its digestive capacity increases, the total quantity of the milk mixture must be increased from time to time; this is, however, not all that will be necessary. In the healthy infant the power to digest the proteids of milk increases rapidly with its age, and consequently this constituent must be increased in quantity in the milk formula prescribed. By the sixth month the following formula may be given:

Percentage.		*By Measure.*	
Fat,	4 per cent.	Cream,	8 ounces
Sugar,	7 "	Milk,	2½ "
Proteids,	2 "	Lime-water,	1 ounce
Lime-water,	5 "	Water,	8½ ounces
			20 ounces
		Sugar of milk,	2½ measures.

The proportion of proteids has here been increased, while the fat and sugar are relatively less. The proteids may thus be increased from time to time until the tenth or twelfth month, at which time the child ought to be able to take whole milk, properly Pasteurized and made alkaline by lime-water, bicarbonate of soda, or table salt. If the child has been fed on breast milk up to the tenth or twelfth month, it may be gradually weaned in the manner previously described. An analysis of the mother's milk may now be made and a corresponding milk mixture used until the child becomes accustomed to an artificial diet, but the ultimate object should now be to prepare the digestion for foods containing other substances than are found in milk, although the latter must still for a considerable period be the principal article of diet.

By the eleventh or twelfth month the capacity to digest starch is fully developed. After this period of life, sugar, as such, is

not the only heat-producing food; in fact, it becomes secondary in importance to starch in this capacity. It must not be supposed that the power of digesting sugar is any feebler, but as starchy foods can be taken and assimilated, the need for sugar is not so great. Following this principle we can with propriety introduce into the child's diet toward the end of the first year of life various foods containing starch, and it is best that we use for the purpose articles which contain this principle in its simplest form. The following may be advantageously used:

Oat or Barley Jelly (the former contains slightly more starch than the latter, while both contain a certain per cent. of fat).—Oat jelly can be made in the following manner: Four ounces (120 gm.) of coarse oatmeal are allowed to soak in a quart of cold water for twelve hours. The mixture is then boiled down so as to make a pint. It is then, while hot, strained through a fine cloth. Barley jelly is made in practically the same manner.

The intervals between feedings will vary somewhat with the age of the child. An average of three hours' interval will do very well until the child is eight or nine months old, when the number of feedings may be decreased and the quantity at each feeding increased. The lengthened interval is quite necessary after the introduction of a proprietary food or a food containing starch.

From the end of the first year of life a child should receive about five meals a day, the first to be given at about 7 A.M., and should consist of eight ounces of modified milk made in the following proportions:

Percentage.		*By Measure.*	
Fat,	4 per cent.	Milk,	6 ounces
Sugar,	5 "	Cream,	1 ounce
Proteids,	3 "	Water,	3 ounces
		Sugar of milk,	two even teaspoonfuls.

This may be varied by the use of barley or oatmeal jelly in the same proportion as the water. At the second meal much the same quantity of milk may be given, or at this feeding one or two tablespoonfuls of one of the standard proprietary foods or "flour ball" may be used.

Flour ball is made as follows: A pint of wheat flour of good quality, without bran, is tied tightly in a pudding bag. This is placed in a saucepan of water and boiled constantly for ten hours. It is then allowed to cool, the bag removed, and the outer covering of dough cut away. The yellowish-white interior of the mass consists almost entirely of dextrin, which has been formed from the starch during the process of cooking. This

interior is reduced to a powder by grating. To prepare for use in a nursing-bottle, rub a teaspoonful of the powder with a tablespoonful of milk until a smooth paste is formed; a second tablespoonful of milk is now added, with constant rubbing. This quantity should be poured into eight ounces of hot milk, the milk being continuously stirred while the paste is poured in.

By the fifteenth month the child, providing it is still on a diet of modified milk, may be given a formula such as the following:

Percentage.		*By Measure.*	
Fat, ...	4 per cent.	Milk, ...	8 ounces
Sugar, ...	5 "	Cream, ...	½ ounce
Proteids, ...	3.5 "	Water, ...	1½ ounces
		Sugar of milk, one even teaspoonful.	

Occasionally the diet may be varied by giving the child at one of the feedings a small quantity of whey. This is prepared as follows: A pint of milk is warmed, and two teaspoonfuls of Fairchild's essence of pepsin are added. The mixture is then allowed to stand until the process of coagulation of the curd is completed. It is then beaten with a fork until the curd is finely subdivided, after which it is strained.

Sometimes a small quantity of animal food may be introduced into the child's diet with benefit; this is particularly the case when an attack of indigestion supervenes. Beef-extract or thin beef or mutton broth can be used for this purpose.

Beef-juice is prepared in the following manner: A pound of beef sirloin should be warmed in a broiler before a quick fire; it should then be cut into small pieces and placed in a lemon-squeezer or meat-press, so as to express the juice, which is caught in a hot cup. All fat should be removed. Care should be taken not to cook the meat.

Beef Broth.—One pound of lean beef should be minced finely and put with its juice into an earthen vessel containing a pint of water at 85° F. (29.4° C.). It should then be allowed to stand for one hour, after which it is strained, preferably through stout muslin, until all the juice is removed from the meat. The liquid is then placed on the fire and heated slowly just to the boiling-point, being stirred all the time; it is then removed and seasoned with salt.

Mutton broth is prepared by gently boiling one pound of loin mutton in three pints of water until the meat is tender; a small quantity of salt should then be added, and the whole strained into a basin; skim off the fat as soon as cold. Both beef and mutton broths should be warmed before giving them to the child.

A child of eight or nine months can occasionally be given the yolk of an egg lightly boiled and mixed with stale bread-crumbs, or a small quantity of a well-roasted potato may be given for one meal a day once or twice a week. When broths are used, they should be given in quantities of about four or five ounces, either plain or mixed with bread-crumbs or finely crumbled Zwieback. Chicken broth may also be used at this time of life as an occasional substitute for milk, or a good proprietary food which can be prepared with milk.

Chicken broth is made in the following manner: A small chicken, or half of a large one, after being thoroughly cleaned and having all the fat and skin removed, is chopped into small pieces, bones and all; a pinch of salt is added and the whole is placed in a saucepan containing a quart of boiling water. The cover of the saucepan should be closed tightly and the contents allowed to simmer over a slow fire for two hours. After removing, allow it to stand, still covered, for an hour. The broth is then strained through a sieve. From three to five ounces should be given at one feeding. As a general rule, broths should only be substituted for milk for about one feeding daily two or three times a week.

The diet from the eighth until the twelfth month should be much the same, except that the amounts of nitrogenous and starchy foods may be steadily increased. It should be borne in mind that every young child needs an occasional change of diet. Their *entire* digestive system should be gradually taught to do its duty. The juices of meats, and even the meat itself finely comminuted, may occasionally be given in small quantities as early as the tenth or eleventh month. It is also necessary to impress on the mind of the mother or nurse that the child needs water; this should be given in quantities of an ounce or two at a time; it should be sterilized by some means or other, preferably by boiling, and the child should be encouraged to drink several times a day. The best method of securing pure water is by means of a Pasteur filter attached to one of the faucets in the kitchen, but as this appliance requires water under pressure such as is found in the water system of cities and is somewhat expensive, it can not be obtained at all households. A very good way to sterilize water is to fill a number of thoroughly cleaned beer-bottles from a hydrant or spring, and after filling the mouth of the bottle with absorbent cotton, to subject the water to boiling temperature for about half an hour. The cotton may then be removed and the bottle tightly stoppered by means of the gum cork and wire attachment if the bottle is equipped with a patent

stopper; otherwise cork tightly. This water may be given to the child cold, or in the heat of summer even with small pieces of ice in it, or, better, cooled by indirect chilling.

In infants or young children suffering from intestinal disorders from five to twenty drops of good brandy or whisky may often be added to each drink of water with advantage. In cases of constipation moderate drafts of oatmeal-water, and in cases of diarrhea allowing the child to have frequent drinks of barley-water, not only satisfy thirst, but do good in relieving these conditions and are valuable adjuncts in the treatment. Both of these are better thirst quenchers than plain water. All the mineral waters have their uses in the therapeutics of childhood, and in fever cases the effervescent mineral waters, particularly aerated Poland, Apollinaris, or simple soda or Vichy water in siphons, are very refreshing. These should be given in quantities of an ounce or two at a time, and may be at times mixed with a small quantity of lemon-juice. Given with cracked ice and with a small quantity of brandy or whisky added, they are very valuable in many cases of severe vomiting. In the renal affections of childhood aerated waters are serviceable in keeping the kidneys well flushed out and aiding the excretion of effete products.

DIET OF CHILDREN FROM THE SECOND YEAR.

At the commencement of the second year of life we find the child still needing milk as a chief constituent of its diet. In bottle-fed babies the milk should be modified so that the albuminoids and fats are considerably increased. A useful formula for this age may be prepared as follows:

Milk,	7½ fluidounces
Cream,	½ fluidounce
Milk-sugar,	1 dram
Salt,	a pinch
Water,	2 fluidounces.

The child should now be given more of ordinary table diet; either the white or yolk (the latter preferred) of a soft-boiled egg may be used for one feeding a day. Broths, such as chicken, mutton, or beef broth, should also be used, and a small quantity of finely chopped or scraped underdone beefsteak may be given for one or two feedings a day. Some form of animal food should almost always be used at least once a day.

For one or two meals each day one of the standard proprietary foods may be given. At this age five meals a day

can be well borne. The first, preferably the foregoing milk formula, should be given at about 7 A.M.; the second, which may be omitted if the child is not hungry, should be taken about 11 A.M.; the third, which should be the heaviest meal of the day, may contain the largest amount of animal food. This should be given at about 1 or 2 o'clock in the afternoon; the fourth feeding, which may be a repetition of the first or consist of milk mixed with one of Liebig's foods, should be taken at about 6 P.M. Before retiring for the night the child may take a cup of warm milk rendered slightly alkaline by lime-water or salt.

Toward the end of the second year a child may receive four meals a day. These should consist of a breakfast composed principally of milk, to which a small quantity of thoroughly cooked oatmeal or wheaten grits or one or two slices of stale bread may be added. A child should never receive fresh or hot bread in any form. At about 10.30 or 11 A.M., if the child is hungry, it may receive a tumbler of warm milk. The dinner should be eaten at about 1 or 2 o'clock, and at this meal the child may be given a small piece of underdone roast-beef or chicken or turkey—any of the lighter meats, in fact. This may be supplemented by one or two vegetables, such as a well-roasted potato mashed with a fork. Such green vegetables as spinach, cauliflower, peas, or string-beans may occasionally be used as alternates for potatoes. At this meal, also, junket, plain rice-pudding, good fresh fruits, and occasionally ice-cream may be used for desserts. In children with weak digestion a tablespoonful of sherry in water given immediately after the dinner is useful. Tea and coffee should be prohibited, but the child may drink a cup of milk or cocoa with good effect. Bread, not too fresh, may also be eaten with the dinner.

At about 7 P.M. the child should receive its last meal; this may be composed of a slice or two of bread and butter or well-made milk toast. About eight ounces of milk may also be taken at this meal. A small quantity of some plainly stewed fruit with the seeds removed is often given with benefit. Unless there are some special indications for it, it is better not to give the child meat at this meal. From this age on the diet of childhood gradually approximates nearer and nearer to that of adult life. It should be remembered that the heaviest meal—the dinner—should be given somewhere near noon. The breakfast and supper should consist largely of milk, although other easily digested foods in quantities to suit the child's age are admissible. It is usually well to give some light food, such as milk, between breakfast and dinner and dinner and supper,

since the intervals between the time of adults' meals are rather too long for the youthful digestive organs to run without some nourishment being supplied. It is advisable to allow no candies or cakes, and thus prevent the child acquiring a taste for them. If this is impossible, such things should be permitted only immediately after a meal, and better only as a special reward for good conduct.

Proprietary Foods.—Many of these foods seem to be quite carefully prepared, and, having the advantages of convenience and cheapness, may be introduced with good results by the end of the first year. It has been taught by some authorities that finely divided starch or dextrin introduced into milk acts in two different ways: first, by its nutrient properties, and, second, by its mechanical action. By the term mechanical action is meant the diffusion of the particles of the food among the globules of fat and the casein of the milk in such a manner as to prevent the formation of masses of curd in the digestive tract of the child. This theory has of late years been disputed, and experiments seem to prove that the action of these substances as attenuants, so called, is of little consequence. As far as their nutritious properties are concerned, the proprietary foods are, as a rule, inferior to milk, for two reasons: First, the proportion of tissue-building to the heat-producing elements is much below that of milk. In the second place the starch, which is a heat-producing principle, must be converted into sugar before it can be absorbed. This change is accomplished by the action of the pancreatic juice and saliva, neither of which is to any extent developed before the fourth month of life. The undigested starch, therefore, remains in the gastro-intestinal canal and is extremely likely to cause fermentation. In order to make up in some degree for their lack of nutritive properties, all farinaceous foods should be prepared with milk, and it really becomes a question whether, in infants under eight or ten months of age, the nutritious principles are not dependent much more on the milk than on the proprietary food. In regard to proprietary foods, it may be said that their best quality is that they form an easy and convenient way of introducing starch or partially dextrinized starch into some modification of milk.

Foods Containing Starch, Dextrin, or Maltose.—Many preparations are sold in which, by previous heating or by digestion with diastase, wheat- or barley-flour is so modified as to be more easily digested than simple starch. By the action of a temperature of 300° or 400° F. (160° or 204.4° C.) the principal substance, starch, forms dextrin, a body differing from starch in the

fact that it is soluble and has the characteristics of a gum. Quoting from the investigations of Professor Leeds, we find that the flour selected for such treatment should be rich in albuminous substances and made from wheat grown at certain seasons and of a certain grade, and should be made by the roller process.

Liebig's Foods.—Under this head may be classed a number of proprietary foods the essential construction of which is as follows: The flour is prepared by means of diastase, equal parts of wheat flour and barley malt being used, and a certain amount of wheat bran being added. The latter substance is used because of the adherent phosphates and nitrogenous matter. To these 1 per cent. of bicarbonate of potassium is added, with water sufficient to make a thin paste. This mixture is allowed to stand for several hours at the ordinary temperature, after which the latter is raised to 150° F. (65.6° C.), and this is continued until all the starch is converted into maltose and dextrin. The mixture is then strained and the residue pressed and exhausted with warm water, after which the extract is evaporated into vacuum pans at a moderate degree of heat. The process is completed by drying at a higher temperature, the mixture being stirred thoroughly. By reference to the table the composition of many of these foods can be seen.

Proprietary Foods Intended to be Used Without Milk.—This class of proprietary foods is prepared with the intention of using them without the addition of milk, water only being necessary to prepare them for the feeding. In the majority of these the starch, which has been partially or completely converted into dextrin, has been evaporated with milk during their manufacture. An outline of their preparation is somewhat as follows: The flour is first made into dough and baked, after which it is finely ground and mixed with condensed milk, and then dried by a slow heat of moderate degree. In the resulting mixture the starch has been wholly or partially converted into maltose, dextrin, or dextrose. The albuminoids of the flour have undergone about the same changes as take place in other farinaceous foods. The milk-sugar has undergone coagulation, and the casein has become dried into a fine powder. An example of this class of foods is the one sold under the name of Nestlé's food.

In regard to the value of these foods we must say that there is no one of them that can be referred to as being the best upon which to feed a large number of children or a single child during a long period of time. That they have a certain amount of usefulness can not be doubted.

TABLE OF THE CONSTITUENTS OF LIQUID FOODS AND PEPTONOIDS.

(From Bulletin No. 10, Department of Agriculture.)

Name or Brand.	Water.	Fat.	Protein.	Carbohydrates.		Fiber.	Ash.	Remarks.
				Soluble.	Insoluble.			
Beef peptonoids (dry),	4.01	3.49	63.18	. . .	. . .	. .	3.54	Specific gravity 1.049.
Bovinine, ...	62.18	Trace.	15.35	. . .	. . .	. .	4.3	Contains alcohol and boric acid.
Bovox, ...	52.23	Trace.	24.49	. . .	. . .	. .	2.18	Specific gravity 1.020.
Murdock's liquid food,	75.81	0.11	12.91	. . .	. . .	. .	5.27	Specific gravity 1.244; contains alcohol.

FOODS FOR INFANTS AND INVALIDS.

Carnrick's soluble food,	3.12	6.26	16.32	56.62	14.44	0.22	3.02	
Horlick's food, ...	3.64	2.01	11.28	63.14	17.28	0.73	1.92	
Horlick's malted milk,	2.87	7.81	16.61	59.43	10.95	0.52	1.81	
Hubbell's prepared wheat, ...	5.93	1.19	14.81	16.16	60.86	0.31	0.44	
Imperial granum, . . .	10.57	1.32	19.37	15.42	51.88	0.31	1.13	
Just's dietetic food, . .	4.83	0.79	3.85	70.6	18.31	0.51	1.11	
Lactopreparata, . .	3.28	6.26	22.48	58.89	7.21	0.81	1.07	
Liebe's soluble food, .	22.03	0.08	3.32	76.38			1.41	
Mellin's food, ...	3.93	2.04	11.87	59.45	17.71	0.53	4.47	
Milkine, ...	2.74	7.12	13.37	61.19	13.63	0.63	1.32	
Nestlé's food, ...	2.37	4.94	11.04	43.75	35.73	0.47	1.61	
Nursing meal, ...	10.84	2.36	6.22	44.66	32.96	0.63	2.31	Contains cocoa.
Nutrico food, ...	11.87	4.38	13.4	9.75	57.83	0.61	1.77	
Ridge's food, ...	8.87	1.67	13.37	8.32	66.35	0.81	0.61	
Wagner's infant food, .	5.07	10.91	14.81	37.91	28.91	0.37	2.01	
Wells, Richardson & Co.'s lactated food, .	2.94	2.67	13.22	28.84	48.45	1.37	2.51	
Zimmerman's health food, ...	6.79	1.33	11.16	14.73	63.97	0.	1.31	

Simple Attenuants.—The principal use of these is to dilute the milk and at the same time add somewhat to its nutritious property. Many of them have a slight therapeutic action upon the intestinal tract of the child. Of those in use, probably the best are barley-water, gelatin-water, and oatmeal-water.

Barley-water can be made as follows: Into a saucepan containing a pint of water put two teaspoonfuls of washed pearl barley, boil slowly down to two-thirds of a pint, and strain.

Gelatin-water: Put a piece of plate gelatin an inch square into half a tumblerful of cold water, and let it stand for three hours. Then turn the whole into a teacup, place this in a saucepan half full of water, and boil until the gelatin is dissolved. One or two teaspoonfuls of this should be added to about four ounces of water. When made with milk, about the same quantity of the jelly is to be used to each bottle containing eight ounces.

Oatmeal-water: To a pint of water add from one to three

tablespoonfuls of well-cooked oatmeal; heat until it has almost reached the boiling-point, and stir constantly.

Lime-water: A piece of unslaked lime the size of an English walnut should be dropped into two quarts of boiled or filtered water contained in an earthen vessel; the water is then stirred thoroughly and allowed to settle. The water should be used only from the top and should be replaced as consumed.

Condensed Milk.—Condensed milk is used largely, especially by the poorer classes, as an article of food for infants. Being sealed in air-tight cans or jars and containing a large quantity of sugar, it is easily preserved for a considerable time. It is also cheap and prepared with comparatively little trouble—both qualities which will recommend it to the poor mother with the cares of a large family. All that is necessary for its preparation is to mix it with a certain quantity of water and pour it into a nursing-bottle. Regarding the relative proportions of the principal elements of condensed milk, Professor Leeds, of Hoboken, found in the analysis of a large number of specimens the following proportions of its constituents:

	Milk Condensed with Cane-sugar Added. No. 1.	The Same Diluted with Eight Times its Weight of Water.
Fat,	12.10	1.51
Albuminoids,	16.07	2.01
Lactose,	16.62	2.08
Sucrose,	22.26	2.78
Ash,	2.61	0.32
Total solids,	69.66	8.70
Water,	30.34	91.30
	100.00	100.00

	Anglo-Swiss Milk, Preserved without added Sugar. No. 2.	American-Swiss, Preserved. No. 3.
Fat,	13.21	11.55
Albuminoids,	11.36	14.10
Lactose,	15.29	13.04
Sucrose,	. .	. .
Ash,	1.78	2.09
Total solids,	41.64	40.78
Water,	58.36	59.22
	100.00	100.00

	Same as 3, Diluted with Five Times its Weight of Water.
Fat,	2.64
Albuminoids,	2.27
Lactose,	3.05
Sucrose,	
Ash,	0.36
Total solids,	8.32
Water,	91.68
	100.00

TABLE SHOWING THE CONSTITUENTS OF EVAPORATED CREAMS AND UNSWEETENED CONDENSED MILKS.*

Name of Brand.	Water. Per cent.	Fat. Per cent.	Protein. Per cent.	Milk-sugar. Per cent.	Cane-sugar. Per cent.	Ash. Per cent.
Evaporated Creams.						
First Swiss,	62.72	10.68	9.23	13.72	. .	2.04
Highland,	68.75	9.63	9.21	10.89	. .	1.52
Howell's,	71.92	8.81	8.53	8.82	. .	1.82
Imperial,	69.54	9.56	8.61	10.42	. .	1.87
Loeflund,	68.37	7.81	10.17	11.84	. .	1.81
Monroe,	69.64	8.91	9.54	10.44	. .	1.47
Romanshorn,	66.28	10.39	9.77	11.47	. .	2.09
St. Charles,	66.46	9.26	10.49	12.24	. .	1.55
Condensed Milks.						
Anglo-Swiss,	21.56	9.37	9.16	13.39	40.45	2.07
Baby,	22.99	10.61	9.91	14.24	40.17	2.08
Dime,	23.88	7.34	10.07	12.7	43.95	1.96
Full Weight,	25.58	9.29	9.44	11.71	42.14	1.84
Gail Borden's "Eagle,"	30.16	7.51	8.4	9.82	42.24	1.87
Good Luck,	27.11	8.29	9.03	12.74	40.87	1.98
Jersey,	24.25	9.86	8.44	12.33	43.19	1.93
Leader,	22.66	9.73	9.23	12.98	43.44	1.96
Magnolia,	25.58	8.04	8.21	10.68	45.48	2.01
Milkmaid,	25.76	9.03	9.33	10.18	43.72	1.98
Nestlé,	24.2	9.81	10.49	11.66	41.63	2.21
Percelain,	24.43	7.01	10.42	12.63	43.8	1.71
Red Cross,	25.97	7.93	8.91	11.93	43.77	1.49
Red Star,	25.55	9.74	9.38	10.87	42.31	2.13
Rival,	21.63	9.36	8.72	11.81	46.61	1.87
Sweet Clover,	24.51	8.31	8.75	11.88	44.58	1.97
United States,	30.29	7.21	8.74	12.04	39.8	1.92

It will be seen by a glance at these tables that while the proportion of lactose and cane-sugar in condensed milk is in excess of that found in human or cow's milk, yet the amount of fat and proteid, as well as the alkaline mineral matters, is considerably

* From Bulletin No. 10, Department of Agriculture.

less. It is true that the large amount of sugar present tends to prevent constipation, but the other elements being disproportionately small makes condensed milk deficient in its general nutritive properties as an article of food.

Children fed on condensed milk soon become fat, and for some time the digestion really seems to be improved; this is more frequently the case if the child is changed to a diet of this substance from one of farinaceous foods. After a continued diet of condensed milk, however, a child generally becomes flabby, restless, or sleepy, suffers from impaired digestion with considerable fermentation, and is apt, sooner or later, to drift into a condition of marasmus. Some of the worst cases of simple atrophy that we have ever seen have been those in which the infants have been fed for a long time on this form of diet. In these children, also, the period of dentition comes later, is irregular and prolonged, and a strong tendency to rickets or a chronic state of malnutrition is manifest. It has also been noticed that if children fed on this diet fall into a subacute diarrhea, it is almost impossible to save their lives.

CHAPTER V.

DISEASES OF THE DIGESTIVE ORGANS.

Of all the diseases of young children with which the physician comes in contact, those referable to a defective digestion will form considerably more than half. In the infant under a year old, and in the young child up to the period of complete dentition, these diseases are found more commonly than any other. The very young child is not so susceptible to acute fevers as older children; it is, of course, not prone to contract the various ailments peculiar to adult life, so that we find that dentition, and the various pathologic conditions associated therewith (all of which are exaggerated by diseased states of the digestive tract), and the acute and chronic affections of the stomach and intestines will cause the largest amount of work for the physician during these earlier years of childlife. It is of special importance, therefore, that the physician who attempts to treat the various diseases in children shall be at least moderately conversant with the disorders affecting the digestive tract of children and the causes on which these diseases chiefly depend.

THE MOUTH.

This orifice plays a very important rôle in the differential diagnosis of the acute exanthemata, on account of the fact that a number of eruptions make their appearance in the mouth two or three days before developing in other parts of the body. In healthy new-born infants the mucous membrane of the mouth is of a pink color, with a very slight secretion of saliva. This continues for the first two or three months of life, toward the end of which time the secretion becomes gradually increased in quantity because of the higher development of the salivary glands. Frequently small flocculi or curds of milk may be seen, and occasionally these must be differentiated from the ulcerative patches of stomatitis or of thrush. As the epithelium of the mucous membrane is exceedingly delicate, it can easily be injured, and may become a point of entrance for bacteria, thus setting up some form of infective disease.

DISEASES OF THE MOUTH.

STOMATITIS.

Varieties.—(1) Simple catarrhal stomatitis; (2) aphthous stomatitis; (3) ulcerative stomatitis; (4) stomatitis mycosa, or parasitic stomatitis; (5) gangrenous stomatitis; (6) diphtheric stomatitis; (7) syphilitic stomatitis; (8) mercurial stomatitis.

1. Simple Catarrhal Stomatitis.

Catarrhal stomatitis consists of a hyperemic condition of the mucous membrane of the mouth, with more or less alteration of its secretion.

Causes.—The causes may be primary or secondary. Among the primary causes are traumatism to the mucous membrane by too vigorous attempts at cleansing the mouth, by the food being too hot, in older children by sharp teeth, or by an irritation or abscess in the gum. As secondary causes we have the various gastro-intestinal diseases, teething, eruptive fevers, and quite frequently whooping-cough. Stomatitis is often found in healthy children as well as in those who are sickly.

Symptoms.—Preceding the onset of the inflammation in the mouth we may have a slight rise of temperature, some vomiting, constipation—symptoms, in fact, showing the onset of any acute disease. In a short time there will be pain in the mouth or throat, these symptoms occasionally being accompanied by enlargement of the lymphatics under the jaw and in the neck. A slight cough not infrequently forms an accompaniment. These symptoms are quickly followed by soreness of the mucous membrane of the mouth, which becomes more and more localized, with increased salivation and fetor of the breath.

When the stomatitis is general, the lips share in the inflammation, becoming swollen and tense. A fine papular eruption, caused by the engorgement of the muciparous follicles of the lips, is often seen. The tongue is coated, sometimes slightly swollen.

Treatment.—A method of treatment often pleasant to the patient consists in the application of cold sterilized water to the interior of the mouth by means of cotton fastened to a stick. The action of these applications can be increased by the addition of boric acid in a strength of 2 or 3 per cent. Weak solutions of sulphate of zinc or salicylate of soda in a strength of about 1 per

cent. are useful remedies. The agent most generally used, and usually with excellent effect, is nitrate of silver in a strength of about 0.5 to 1.5 per cent.

Applications of alum, made by gently touching the inflamed spot with a single crystal, sometimes give good results. The food should be bland, and all condiments should be avoided. It is often more grateful to the patient to have the food given cold. Attention should be directed to the digestion, and the bowels be kept open by laxatives.

2. Aphthous Stomatitis.

Synonyms.—Vesicular Stomatitis ; Follicular Stomatitis ; Aphthous Sore Mouth.

Aphthous stomatitis consists in a hyperemia of the mucous membrane of the mouth, accompanied by the formation of small superficial ulcers.

Causes.—Aphthous stomatitis is most common from the tenth to the thirteenth month of life, although it may occur at any age. The direct causes are rather obscure, although micro-organisms would seem to play an important part in the etiology. Siegel describes an ovoid bacillus 0.5 μ in length, which he found in the buccal secretion taken from patients seen during an epidemic in Germany. The disease frequently follows gastro-intestinal diseases, acute fevers, and pneumonia. Preceding the inflammation of the mouth the symptoms of high fever, increased salivation, vomiting, and constipation—in fact, the same symptoms which may precede any of the acute fevers—may be present. The heat and pain in the mouth increase and there may be some enlargement of the lymphatics. The inflammation of the mouth soon localizes itself into small ulcers of round or oval shape and of yellowish-white color, each ulcer being surrounded by a red areola. The ulcers may appear simultaneously, or they may come in successive crops.

Treatment.—The treatment consists in opening the bowels with a gentle laxative and regulating the diet. In this form of stomatitis applications of chlorate of potassium, in the strength of from twenty to twenty-five grains to the ounce, seem to work remarkably well. The cause of the inflammation, so far as possible, should be removed ; the roots of decayed teeth should be taken out, and diseased teeth attended to. The local treatment consists in the application of chlorate of potassium or silver nitrate. Since many of the children affected by this disease are in poor general health, tonics, such as the various preparations

of iron and quinin, are indicated. When the mouth is so sore that food can not be taken in this way, nutritive enemata should be used. The irritation caused by the highly acid secretion of the mouth may be relieved by gently washing out with a solution of borax or bicarbonate of soda. The mouth must be kept clean, but it should be borne in mind that all applications must be applied with great care.

A form of aphthous stomatitis only found in the new-born and described under the name of Bednar's aphthæ consists in a number of shallow ulcers covered by a gray or yellowish coating, which are found upon the soft palate and the posterior part of the hard palate. This form of aphthæ is always produced by a too violent cleansing of the mouth, although it is occasionally found resulting from the use of badly shaped rubber nipples (Forchheimer). The treatment consists in the application of bland antiseptic washes.

3. Ulcerative Stomatitis.

"This is a peculiar process, characterized by destruction of tissue, beginning on the gums around the teeth, never extending beyond the mouth, infecting healthy parts of the mouth, and never occurring where there are no teeth" (Forchheimer).

Causes.—Ulcerative stomatitis is rarely found in children under five years of age unless produced artificially by such drugs as mercury. It usually occurs in children living amid bad hygienic surroundings, particularly when these are associated with poor nourishment. It is occasionally seen following such diseases as scarlet fever or measles, although it is possible for it to occur in any condition in which the health is greatly depreciated. It is generally considered to be noncontagious. A mild form of ulcerative stomatitis of scorbutic origin is occasionally met in infants who have been fed on sterilized milk for a long time.

Symptoms.—The disease usually commences with an inflammation of the gums surrounding the incisors, and is most apt to affect those of the lower jaw. The gums become swollen, red, and spongy. In a short time a line of ulcers extends from the point of origin around the gums to the cheek. These ulcers are usually gray in color, although occasionally they are of a yellowish hue. In a short time sloughing of the tissue follows and the teeth become detached from the gums, the resulting cavity being filled with a mucopurulent secretion. The quantity of saliva is increased, and this secretion, becoming mixed with

discharges from the ulcers, produces a peculiar fetid odor in the saliva and breath. In very bad cases the maxillary bones themselves, particularly the inferior one, may be attacked. An eczematous eruption may appear around the lips, caused by the irritation of the saliva. The submaxillary lymphatics become enlarged, but this enlargement rarely tends to suppuration.

In very bad cases the tongue and the entire mucous membrane may become affected, and the part of the latter covering the gum of the lower jaw may be entirely destroyed by ulceration. This is the form of stomatitis which is most commonly associated with scorbutus.

The prognosis depends on the extent of the disease. When scurvy is the cause, or when any great destruction of bone has occurred, the prognosis is grave.

Treatment.—The treatment is both prophylactic and curative. The prevention of the disease is accomplished by improving, so far as possible, the hygienic surroundings of the patient and by the judicious use of good food and tonics. According to many authorities, chlorate of potassium is regarded as almost a specific in the disease. It should be given in about 3 per cent. solutions, the effects of the drug being carefully watched. A very good formula recommended by Starr is as follows:

Potassium chlorate,	58 grains
Dilute hydrochloric acid,	1 fluidram
Syrup,	½ fluidram
Water, to make	3 fluidrams.

SIG.—One teaspoonful, diluted in water, for a child three years old.

When this disease is associated with carious teeth, or if the bone has become involved, the affected structures must be removed. When extreme fetor of the breath occurs, the mouth should be washed out with weak solutions of permanganate of potash or a solution of the hypochlorites. In some cases alcoholic stimulants are indicated. Unquestionably, chlorate of potassium is the most successful remedy in this disease.

4. Stomatitis Mycosa or Parasitic Stomatitis.

Synonyms.—Thrush; Soor; Muguet; Sprue; Millet.

The disease consists of a yellowish-white growth of parasitic origin, occurring on the mucous membrane of the mouth.

Causes.—The direct cause of mycotic stomatitis is the oïdium albicans. It is probable that this fungus is, in the majority of

cases, carried into the mouth by the nipple or the nursing-bottle. Either healthy or unhealthy children may have the disease, but those who have had some slight catarrhal inflammation of the mouth are especially predisposed to it. Thrush is especially found in poorly nourished infants and in those who are bottle-fed. Any cause producing mechanical injury to the mouth will predispose to the development of thrush fungus. Like other forms of stomatitis, it may occur in children recovering from some prolonged illness.

Symptoms.—Quite often there are no premonitory symptoms of thrush, the spots themselves being the first indication of the disease. These are of a grayish-white color, of variable size, and rest on the mucous membrane, occasionally, but not always, being elevated above the surface. They appear first on the internal surface of the cheeks and dorsum of the tongue, and then extend backward to the soft palate or forward to the lips. The patches have occasionally been found in the pharynx and esophagus. An examination of these patches by reflected light shows them to be developed within the epithelium, each being surrounded by a narrow ring of injected blood-vessels. As development progresses the spot is pushed up above the level of the mucous membrane. Occasionally the upper coat of a spot will drop off, leaving quite a deep ulcer. In bad cases a number of these ulcers will become confluent, their covering of fungus forming a sort of membrane. Microscopic examination of scrapings taken from these spots will demonstrate the presence of saccharomyces or the oïdium albicans.

Treatment.—The prophylactic treatment of parasitic stomatitis consists in careful attention to the mouth of the child, the avoidance of all forcible attempts at cleanliness, and of abrasions of the mucous membranes. The nursing-bottle and nipple must be kept antiseptically clean.

The curative treatment consists in the application to the mucous membrane of solutions of borax or bicarbonate of soda, either mixed with water or some syrup. A very good prescription is the following:

℞. Acid. carbolic., ... gr. ij
Sodii salicylas,
Sodii biboras, ... āā gr. xxx
Glycerin, ... ℥ij
Aqua rosæ, ... q. s. ad f℥j.
SIG.—For local application.

5. Gangrenous Stomatitis.

Synonyms.—Cancrum Oris; Noma; Oral Gangrene; Wangenbrand.

Gangrenous stomatitis consists in a rapidly developing inflammation of the cheek and adjacent tissues, accompanied by gangrene and destruction of the affected parts.

Causes.—This form of inflammation of the mouth is rarely seen in children under two years of age. From the second until the twelfth year is the period during which it is most likely to occur. Although the origin is somewhat obscure, it is possible that it may be microbic. From the manner in which it occurs, several cases in the same hospital being affected at one time, it would seem that there might be an infectious element in its causation. It is most common in debilitated children—those long suffering from improper food and bad hygienic surroundings or from the results of some infectious disease. It is said to be particularly common after measles and typhus fever, although it is not uncommon after any of the acute exanthemata. The excessive use of mercury is also an occasional cause.

Pathology.—Cancrum oris presents all the pathologic changes of acute phlegmonous gangrene in any other part of the body. We have here, as in other forms of gangrene, the three zones: In the center is the zone of blackened, destroyed tissue, around the outer margin of which can be seen the second zone, consisting of connective-tissue cells in a state of active division. The blood-vessels will be found closed by thrombi consisting of various forms of microbic life. The third or outer zone consists of healthy tissue.

Symptoms.—During or following convalescence from one of the acute fevers, or in a debilitated child, a small nodule, somewhat hard and sensitive, will appear on the gum or on one of the cheeks. The skin or mucous membrane surrounding it will be either hard and swollen or, as is not infrequently seen when the disease attacks the cheek first, there is simple swelling accompanied by considerable edema of the affected part. Although pain is usually complained of, there is occasionally very little discomfort connected with the progress of this disease. The mucous membrane underlying the external swelling puffs up, forming a vesicle which is filled by an ichorous fluid. This vesicle rapidly changes into a gangrenous ulcer of a blackish or reddish-brown hue. The lymphatics of the neck quickly become infiltrated on the same side as the affected cheek. The

skin of the cheek changes to a bluish color over the point of primary induration. The ulcer rapidly deepens and spreads, first perforating the cheek, then continuing the destruction of tissue until the entire side of the face is destroyed. The disease may involve the whole of the cheek, the neck, and even the eye on one side, but it very rarely becomes bilateral; the bones and teeth of the infected side are entirely laid bare. Gangrene of the mouth is accompanied by great constitutional depression.

FIG. 19.—GANGRENOUS STOMATITIS.—(*Dr. Stengel's case at the Children's Hospital.*)

The temperature is variable: sometimes considerable fever is found, but as the disease progresses and septicemic symptoms arise we usually find the fever assuming the character found in septicemia elsewhere.

Before death occurs the temperature is occasionally subnormal. The sequelæ of the disease are septic pneumonia, caused by the inspiration of infected material, and diarrhea, also

of septic origin. Diphtheria has been observed in a number of cases.* As the blood-vessels of the affected part are usually filled with thrombi, perforation of these very rarely causes hemorrhage. Spontaneous recovery from this disease is extremely rare, the mortality being given as from 70 to 90 per cent. of all cases affected.

Treatment.—The best treatment of gangrenous stomatitis lies in its prevention. With this object in view, a child sick with any of the infectious fevers should be placed amid the best hygienic surroundings and its general health kept in as good order as possible by tonics and nourishing food. When the disease has once started, the system should be stimulated by concentrated nourishment, such as meat, milk, eggs, etc. Alcoholic stimulants are particularly indicated here, as in any form of septic infection. The gangrene should be kept from spreading by a thorough cauterization of the tissues immediately surrounding the ulcer. This can best be done by the use of the Paquelin cautery, the galvanocautery, caustic soda, or fuming nitric acid. In order to lessen the horrible stench which arises from the gangrenous tissue the mouth should be swabbed out thoroughly and the ulcer treated with permanganate of potash, carbolic acid, pure peroxid of hydrogen (the latter is very useful), or iodoform and bismuth.

6. Diphtheric Stomatitis (Croupous Stomatitis).

This rare form of stomatitis may be of primary or secondary origin. When primary, the point of development of the membrane is usually on the lips, extending thence to any part of the mouth. Secondarily it may spread from an infected tonsil to the lips, gums, or cheeks. A form of croupous stomatitis may arise from excessive use of irritating drugs used as mouth-washes. In the true form of diphtheric stomatitis the Klebs-Loeffler bacillus will be found.

Symptoms.—When the disease is of true diphtheric origin, the symptoms will be those of ordinary diphtheria. Occasionally the symptoms are obscure, and the ulcers may be well developed before they are discovered. The duration of the membrane is usually from three to six days, although it may last longer. Salivation usually forms an accompanying symptom, both it and the breath having a strong fetid odor. As the membrane sepa-

* In an epidemic of measles at St. Vincent's Home, under our observation at the present time, diphtheria complicates half the cases, and five deaths have occurred from cancrum oris. Two patients affected with the disease have recovered.

rates there may be more or less hemorrhage, caused by the exposure of small blood-vessels which have been eaten into by the disease. This hemorrhage may sometimes be quite severe.

Treatment.—The treatment is the same as that of ordinary diphtheria. When it is possible, the membrane should be carefully removed and the remaining ulcer washed thoroughly with corrosive sublimate, peroxid of hydrogen, or Loeffler's solution. In the croupous form, resulting from irritation, soothing antiseptic washes should be used. Treatment by the use of injections of antitoxin should always be resorted to, and the system supported by tonics and good food.

Syphilitic Stomatitis.

The primary infection of syphilis may occur in the mouth, the usual site of the chancre in this case being the lips. The origin of the infection is usually by transmission from a wet-nurse having the disease. The evidences of secondary syphilis of the mouth are not at all uncommon, and may be found on any part of the mucous membrane. The most common forms are those known as syphilitic fissures or rhagades. These usually occur at the angles of the mouth or upon the upper or the lower lip; they may be single or multiple, and cause considerable pain. These fissures are very slow to heal spontaneously, and even after this has taken place they generally leave a disfiguring scar. Syphilitic papules are also found quite commonly, their seat being the commissure of the mouth and the free borders of the lips. If these split, they may resemble the former variety quite closely. In their elevation, position, and in the moisture which covers their surface they resemble condylomata lata. The ordinary mucous patch of syphilis may also be found, either on any part of the mucous membrane lining the mouth or on the tongue.

Treatment.—The treatment is that of syphilis generally. The affected parts should be treated by applications of corrosive sublimate, either in the strong solution, applied with a brush, or in a weaker form, to be used as a mouth-wash.

7. Mercurial Stomatitis (Ptyalism).

This consists in an inflammation of the mucous membrane of the mouth, attended by a great increase in the quantity of saliva and an alteration in the character of the secretion.

Causes.—The most common cause is the administration of too large a dose of mercury, long-continued use of the drug, or an unusual susceptibility of the patient.

Symptoms.—The first manifestation of ptyalism is an extreme tenderness of the gums, this being particularly felt in biting or in snapping the jaws together. The gums soon become red and swollen, the latter being greatest at the point of insertion of the teeth. There is usually a metallic taste in the mouth, although in children this will not often be complained of, because the patient is too young to associate cause with effect. The secretion of saliva becomes profuse, so that the patient is continually endeavoring to expectorate. The breath is fetid, the tongue swollen, and if the poisoning is severe, the tongue may even protrude from the mouth. Ulcerative stomatitis may follow, and loosening and dropping out of the teeth sometimes occur in severe cases. Complete necrosis of the maxillary bone occasionally follows.

Treatment.—The first indication of treatment is to stop the administration of mercurials. In order to increase elimination small doses of potassium iodid may be used, and this may further be aided by the use of saline laxatives. Frequent bathing and friction of the skin will help in this object. In order to check the hypersecretion of saliva small doses of belladonna will be found useful. When the pain and distress are great, opium may be used, although great care must be exercised in the administration of this drug, particularly to young children.

THE TONGUE.

Parenchymatous inflammation of the organ (glossitis) is quite rare in children, but the tongue and mouth often act as indicators for diseases in other parts of the body. Thus we have a blue tongue as a symptom of cyanosis; the pale or colorless tongue seen after severe hemorrhage or in conditions of anemia; the coated tongue found in all diseases of the digestive tract; the red and glazed tongue, with its border of coating, seen in certain fevers. It should be remembered, however, that no special organisms have been found in the fur of the tongue, and it would be futile to speak of any specific coatings for any one given disease.

DISEASES OF THE TONGUE.

The tongue may be congenitally above or below the normal size, the former condition being known as *macroglossia* and the latter as *microglossia*.

The first is usually found in two forms: (1) The fibrinous,

in which the connective tissue of the organ is increased. (2) "A cavernous cystoid degeneration of the interstitial connective tissue, by which the resulting spaces come into connection with the lymph-vessels, constituting a condition closely resembling cavernous angioma, from which it receives its name of lymphangioma cavernosum" (Rotch).

FIBRINOUS MACROGLOSSIA.

Symptoms.—The tongue is much enlarged, is of a bluish or violet color, and is generally covered with a whitish or grayish

FIG. 20.—MACROGLOSSIA.—(*Dr. W. W. Keen's Case.*)

coat. Indentations or ulceration of the organ, especially along the edges, may occur from pressure of the teeth. From the size of the tongue respiration and deglutition may be interfered with. The lips, and especially the lower one, become thick, edematous, or ulcerated, and salivation is always present. Macroglossia is most frequently found in deformed subjects or cretins.

Treatment.—The treatment is usually palliative. The tongue should be kept clean with warm, slightly alkaline solutions, or when the organ, by its size, threatens the stoppage of respiration or deglutition, part of it should be removed.

A rare condition, known as *lingua geographica*, or "mappy tongue," has been described. The symptoms are the appearance of one or more small patches on the dorsum of the tongue, these patches frequently spreading, uniting so that the entire surface of the organ may be covered. The patches are red in color, smooth, and the filiform papillæ are absent. The unaffected portions of the tongue are normal, except that the papillæ on the borders of the denuded portions are white and prominent. The condition has no special significance and needs no treatment.

GLOSSITIS.

Definition.—An acute inflammation of the parenchyma of the tongue.

Symptoms.—Pain and swelling of the organ, accompanied by a rise of temperature and a hypersecretion of saliva. Occasionally enlargement of the tongue may interfere with respiration.

Causes.—The disease usually arises from direct injury to the tongue, as in the swallowing of irritating substances. The inflammation may occasionally be septic in origin.

Treatment.—The treatment is purely symptomatic, depending upon the cause.

RANULA.

Ranula is a cystic tumor of varying size, found on one or the other side of the frenum of the tongue. The tumor is semi-translucent, soft, and over it are seen dilated veins. Its contents consist of a clear, glairy fluid of mucoid character. Its cause is in some cases rather obscure. It is probable that it is due to dilatation of the ducts of the salivary glands or to an obstruction of the ducts of the sublingual mucous glands. These tumors generally give rise to little or no pain. They are rather rare in childhood.

Treatment.—The contents of the cyst should be emptied, and as recurrence is one of the characteristics of this form of tumor, it is necessary to destroy the lining membrane by the use of caustic. It has been recommended that fifteen minims of a mixture of tincture of iodin and water, of each ten parts, with iodid of potassium one part, will prevent the cyst from filling again. It is probable, however, that a more satisfactory result can be obtained by the application of nitrate of silver to the sac after its contents have been removed.

DENTITION, NORMAL AND DELAYED.

Physiology of the Development of the Teeth.—At about the seventh week of intra-uterine life the stratified epithelium of the mucous membrane of the two maxillæ becomes thickened, forming a ridge. This process passes downward into a recess of the developing embryonic jaw, and is known as the enamel groove. The downward growth, or invagination, of the epithelium forms what is known as the enamel germ, its position being indicated by a slight groove in the mucous membrane of the jaw. Next we find the enamel groove and enamel germ elongating downward, the deeper part declining outward, forming an angle to the upper portion or neck. After this there is an increased development at certain points corresponding to the situation of the future milk-teeth. The common enamel germ now becomes divided at its deeper portion into a number of divisions, each forming what may be called a special enamel germ, which corresponds to what will later be the milk-teeth, or, more properly, each enamel germ will later form an individual tooth contained in its own dental sac. About this time there grows up from the underlying tissue into each enamel germ a distinct vascular papilla, known as the dental papilla, and upon it the enamel germ adheres. This enamel germ consists of three layers, or, as it is sometimes described, as two layers of epithelium separated by an interval. While part of the subepithelial tissue is elevated to form the dental papillæ, the part which bounds the embryonic teeth forms the dental sacs, and the embryonic jaw, which at first is merely a groove of bone in which the dental germs lie, now sends up processes, forming divisions or partitions separating the teeth from one another. The papilla is composed of nucleated cells arranged in a meshwork, the outer or peripheral part of which is covered with a layer of special columnar nucleated cells called odontoblasts ; these latter form the dentin, while the remainder of the papilla forms the tooth-pulp. As the dentin increases in thickness the papillæ diminish in size, and when the tooth is cut, only a small amount remains as the dental pulp, and in this run the blood-vessels and branches of the inferior dental nerve, which enter the tooth at the inferior extremity of each fang. The enamel consists of three parts : (1) An inner membrane composed of a layer of columnar epithelium in contact with the dentin, called enamel cells ; external to this we find one or more layers of small polyhedral nucleated cells ; (2) an outer membrane consisting of several layers of epithelium ; (3) lastly, a middle membrane, formed

of a matrix of nonvascular, gelatinous tissue containing a hyaline interstitial substance. The enamel is formed by the enamel cells of the outer membrane. The development of the teeth progresses steadily from birth during the whole period of infant life. As each tooth, contained in its dental sac and set in its small cavity of bone, develops, elongation takes place, beginning at the fang. In its growth the tooth follows the path of least resistance, which is always toward the mucous membrane, which at the period of birth covers it. Finally, from pressure against the mucous membrane, atrophy or absorption of the latter takes place and the tooth appears above the level of the mucous membrane.

As the child advances in years the temporary or milk-teeth are gradually replaced by the permanent teeth, which push their way up from beneath the former, absorbing in their growth the whole of the fang of each of the first set until little is left except the crown, which finally comes away.

The age at which the first tooth appears varies considerably, this difference depending upon many causes. As a general rule, in healthy children the first tooth appears about the sixth to the eighth month. The eruption of the teeth begins later in children affected by rachitis, syphilis, or tuberculosis, or in those who may be classified under a general head as being "feeble children." The lower central incisor usually appears first, and from this time dentition may be divided into five periods, between each of which is an interval of varying length, sometimes known as interdental intervals. The *first period* occupies the time when the two lower incisors are cut. In the *second period* the four upper incisors make their appearance, these being followed very often by an interval of several weeks. The *third period* is that in which the lower lateral incisors and the anterior molars of the upper and lower jaw are cut; this lasts from the twelfth to the fourteenth month, and is usually followed by quite a long interval of rest. The *fourth period* begins at about the eighteenth or twentieth month, and it is at about this time that the canines appear. The *fifth period* occurs at two and a half years of age, when the posterior molars are cut. The entire "milk-set" is composed of twenty teeth, ten in each jaw, arranged as follows:

Dental Periods.	Age.	Group of Teeth.
I,	6 to 8 months,	Two middle lower incisors.
II,	8 to 10 "	Four upper incisors.
III,	12 to 14 "	Two lower lateral incisors and four first molars.
IV,	18 to 20 "	Four canines.
V,	28 to 32 "	Four second molars.

At birth the jaw contains the entire milk-set, the crowns of which are calcified. Besides these there is one member of the second set—the six-years-old molar—the calcification of which begins during uterine life, at about the sixth month. The permanent incisors begin to calcify during the first month of life; the canines in the first or second year. Calcification of the crown of the second molar is completed about the fourth year, and of the third permanent molar, or wisdom-tooth, at from seventeen to twenty-five years. Thirty-two teeth in all comprise the second or permanent set, and during their development the jaws increase in length to provide for the greater number of teeth. The second dentition can not be divided into so clearly marked periods as the first, but the ages at which the teeth make their appearance are, generally speaking, as follows (it must be remembered, how-

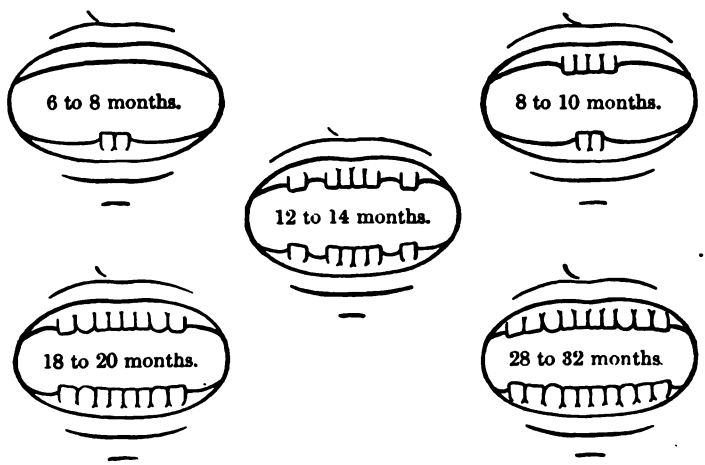


FIG. 21.—DIAGRAM SHOWING THE ORDER OF THE ERUPTION OF THE MILK-TEETH.

ever, that many causes which delay the eruption of the first teeth will also retard the second set):

YEARS.	GROUPS.
Six,	Four first molars.
Seven,	Four middle incisors.
Eight,	Four lateral incisors.
Nine,	Four first bicuspids.
Ten,	Four second bicuspids.
Eleven,	Four canines.
Twelve,	Four second molars.
Seventeen to twenty-five,	Four third molars (wisdom-teeth).

Dentition being a physiologic process, there should be no

symptoms of a pathologic nature which can be attributed to it. It is true that various disorders, principally referable to the nervous system, the respiration, the skin, the digestive system,

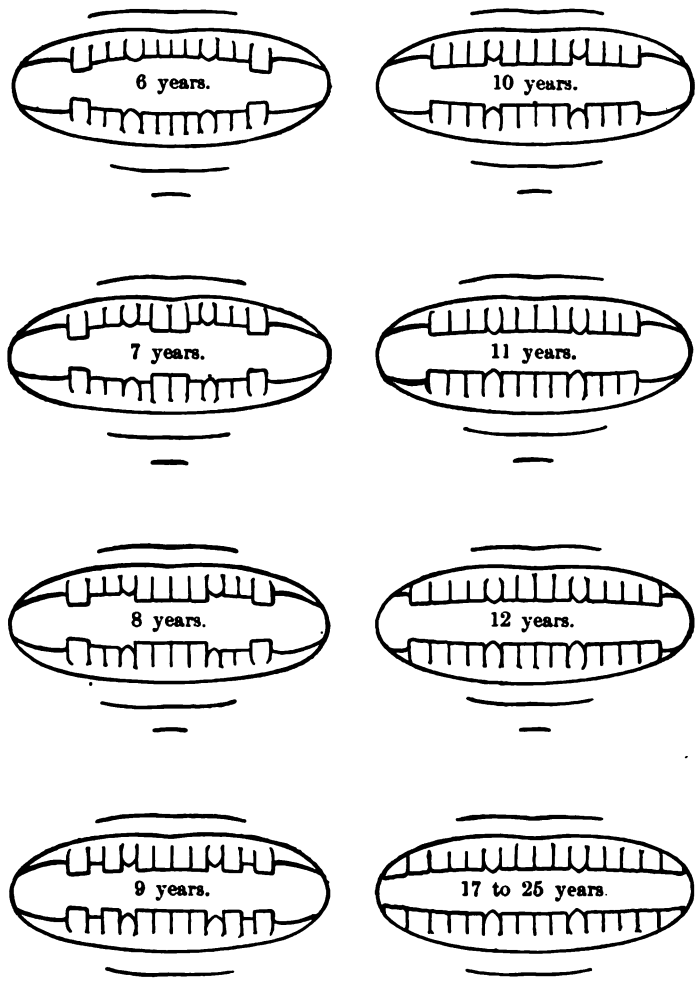


FIG. 22.—DIAGRAM SHOWING THE ORDER OF ERUPTION OF THE PERMANENT TEETH. —(*From Rotch.*)

and organs of special sense, have been associated with it, but if the child at the time of dentition is in a thoroughly healthy condition, there should be no bad symptoms other than some irri-

tability of temper, restlessness, and possibly a slight disturbance of the alimentary tract. Even the latter is by no means a necessary consequence. The gastro-intestinal tract is more predisposed to fermentative diarrheas during dentition, but these are not primarily caused by teething, but by infection from without, the intestinal tract being in a more irritable condition at this time, and therefore less resistant to external sources of infection.

One of the complications of dentition most dreaded by mothers are convulsions. Leaving out of the question those children with neurotic histories or those whose constitutions have been weakened by inherited syphilis, rachitis, or tuberculosis, we can not now recall a single case in which teething has primarily caused convulsions. In the majority of patients who have come under our notice with convulsions during dentition the cause could almost invariably be traced to an attack of acute indigestion in a child whose digestive apparatus was in a hypersensitive state at this particular time; the primary cause, however, has been a badly regulated diet, and not the cutting of the tooth. Bronchitis and bronchopneumonia have also been ascribed to dentition. It is true that a slight irritation of the faucial or nasal mucous membrane may, in a sensitive child, be produced by sympathetic irritation; but here again we must say that we have never seen a case of either of the before-mentioned diseases arise from dentition. A slight erythematous rash, formerly known as tooth-rash and still associated with dentition in the minds of parents, sometimes covers the body at various intervals during this period, but as children affected by it have always at the same time had gastro-intestinal disorders, we can not believe that dentition was responsible for the cutaneous affection. In children affected by struma or in rachitic babies it is not uncommon to find enlargement of the glands of the neck or some irritation of the ears.

Ordinarily a healthy child will evince no symptoms severe enough to demand any special treatment. When, however, an infant is feverish, restless, and irritable, it is proper that the physician endeavor to quiet this condition by suitable medicinal means. Small repeated doses of bromids with camphor water, or, what we have found more useful, small doses of antipyrin, will generally bring about this result. A prescription which we have frequently employed is as follows:

℞. Sodii bromid., ... gr. ij
Antipyrin, ... gr. i–ij
Glycerin., ... ♏iij
Spirit. menthæ piperitæ, ... gtt. ss–j
Aqua camph. (or soda-mint mixture), ... ℥j.
SIG.—To be repeated every two or three hours until the child is quieted.

During the period of dentition the child's diet should receive the strictest care, as it is at this time that the most virulent forms of intestinal diseases frequently make their appearance. The "second summer," which is looked upon with so much dread by mothers, is frequently coincident with the period of active dentition, and it must be borne in mind that at this time the nervous system is generally in a more or less hypersensitive condition, and therefore the digestive system, sharing in this irritability, is less able to combat the attacks made on it by external causes of infection. Children whose systems are enfeebled from constitutional diseases should be appropriately treated, and rachitic or strumous patients, who are apt to be especially depressed at this time and are always slow in cutting their teeth, should be treated by the administration of oils and such remedies as phosphorus and the salts of calcium and general tonics. When a tooth is slow in coming through the gum and its eruption is accompanied by a decided and continued rise of temperature or severe nervous symptoms, lancing the gum is often beneficial. Unless the physician has a clear idea of the exact position of the tooth which is causing the trouble, gum-lancing is of very little use and simply produces an open wound, which always offers an entrance-point for infective germs. The custom of indiscriminate gum-lancing is to be condemned.

DISEASES OF THE ESOPHAGUS.

ESOPHAGITIS.

Inflammations of the esophagus are of rare occurrence in children. It is stated that inflammations of the mouth, although very common, extend but rarely into the esophagus.

Acute Esophagitis.

Inflammation of the esophagus may be caused by lacerations produced by swallowing a foreign body or by corrosive poisons. Either of these causes may involve the mucous membrane or may extend into the muscular coat. The latter is, however, of rare occurrence. When a foreign body has been swallowed, the early symptoms are pain or swelling and a general discomfort in the region. When strong acids or caustic alkalies have been taken into the mouth, the mucous membrane of the latter will be inflamed and ulcerated, the character of both varying somewhat with the poison taken. There will be a burning pain in all the

parts affected, great thirst, and a spasm of the esophagus following attempts at swallowing. Deglutition is almost impossible. The period of acute inflammation will last several days, and during this time there is often great danger of suffocation from edema of the glottis. Later, symptoms of stricture are very common, these usually occurring in from three to six months after the injury.

Treatment.—The indications for treatment are to remove the foreign body, and when the inflammation is produced by poisons, to neutralize the latter as quickly as possible by the use of oils, demulcent drinks, and ice. For the pain, opium is indicated. The treatment of stricture of the esophagus is surgical.

DISEASES OF THE STOMACH.

GASTRITIS.

Synonyms.—ACUTE GASTRIC CATARRH; ACUTE DYSPEPSIA; GASTRIC FEVER; GASTRO-ADENITIS.

Varieties.—Acute gastritis; chronic gastritis; ulcerative gastritis; gastromalacia.

Acute gastritis is an acute inflammation of the glandular tissue of the stomach, interfering with the digestive functions, and generally due to the presence of irritating ingesta (Blackader).

Causes.—By far the most frequent cause is food improper in kind, quantity, preparation, or time of use. Although acute gastritis rarely occurs in young children fed on breast milk, yet it is occasionally seen. In most cases the attack can be traced to some morsel of coarse "table food," candy, or cakes. The substitution of artificial feeding in nurslings, especially when the food is improperly prepared, is another frequent and powerful cause. Unsterilized water often produces acute dyspepsia. An attack of acute gastritis sometimes precedes the eruption of a tooth, although in many instances it is hard to prove whether the attack is due primarily to disordered dentition or to some error in diet during this epoch when the whole digestive tract is in a more or less irritable state.

In older children large quantities of food taken at one time, late meals, highly spiced articles, too great a variety of food, and very rapid eating are the most common causes. Children born with an enfeebled nervous system and those reared on pro-

prietary foods are particularly liable to gastritis. Sudden chilling of the skin has been shown to be an occasional cause.

Symptoms.—At the onset of an attack of gastritis a child who has previously been reasonably healthy loses interest in its play and surroundings. If asleep, it may awake crying and complaining of pain, usually referred to the abdomen. In young children the thighs are then flexed on the abdomen and the legs on the thighs; the arms also are flexed. The crying is sharp, shrill, and continuous, and around the mouth and chin there is generally a pale-blue line. In the febrile type the temperature may rise to 102° to 103° F. (38.9° to 39.4° C.). The pulse and respiration are both accelerated. Vomiting is an almost constant symptom, accompanied by nausea and full unloading or retching; this vomiting must never be mistaken for the simple regurgitation of milk which occurs when the infant has taken more than the stomach can hold.

Upon examination of the vomited matter hydrochloric acid will be found to be deficient. The emesis may continue for a considerable time after the contents of the stomach have been evacuated. The tongue is usually covered with a white or brownish-white coat; this coating is particularly heavy at the base of the tongue, while the tip and edges of the latter are a bright red. There is complete loss of appetite, and when the intestines become involved (as they nearly always are to some extent), there will be diarrhea, with the expulsion, first, of the normal contents of the bowels, and, later, large quantities of mucus. Occasionally the attack is ushered in by convulsions, which are sometimes quite severe, and one of the authors remembers a child five years of age who, forty-eight hours after having eaten a large variety of cakes and candy, was taken with violent convulsions of an eclamptic character. Unconsciousness was to all appearances profound; the temperature and pulse were both considerably above normal, and the type of spasm was first tonic, followed by a long-continued series of clonic movements. The symptoms rapidly disappeared after thorough evacuation of the stomach and bowels, wrapping the child in a hot wet-pack, and stimulation of the rapidly failing heart by hypodermic injections of strychnin and atropin.

Other symptoms of acute gastritis which are noticed particularly in older children are: Tenderness in the epigastrium, with a moderate distention of the abdomen, often causing pain or uneasiness on the slightest touch; headache, which may be general or confined to the frontal or occipital regions; occasionally pharyngitis may appear. Phenomena simulating profound nervous

disturbance may occasionally be met; thus, Seibert has reported a number of cases in which the symptoms of gastritis closely resembled those of cerebral meningitis, and instances in which aphasia and hemiplegia followed the eating of a large amount of indigestible food are reported by Henoch, Fraenkel, and others. When the inflammation extends as far as the duodenum, an attack of catarrhal jaundice may follow within a day or two. If the attack is not very severe, the symptoms will subside rapidly in from one to three days. When severe or when the cause is not quickly removed, the stomach may remain inflamed for several days, the gastric irritation being accompanied by fever and evidences of rather severe exhaustion.

Pathology.—The mucous membrane of the stomach appears swollen and reddened. In severe attacks erosions and even slight hemorrhages may be found. The tissue beneath the mucous membrane—the submucosa—will be found edematous; when seen through a microscope, the interstitial tissue is infiltrated with leukocytes, and the differentiation between the parietal and principal cells can not be made out. All the cells appear cloudy and granular and partially separated from the membrana propria of the gland. There is a great abundance of the mucous cells in the pyloric region, and this increase extends deeply into the ducts of the gland.

Prognosis.—The prognosis of acute gastritis is good, except when the child has for a long time been badly nourished. It is less favorable in bottle-fed babies and in older children when the attack is complicated by severe convulsions. If nephritis is coexistent, or when the attack occurs at the end of one of the continued fevers, the outlook is not so good.

Treatment.—In an attack of acute indigestion the first indication is to remove the irritating material as quickly as possible. With this object in view the vomiting should not be checked unless it produces severe exhaustion. Indeed, very frequently it is well to aid the expulsion of undigested food by the administration of emetics, such as weak mustard-water or ipecac. Ipecac is best given in the form of syrup or wine, in teaspoonful doses, repeated until vomiting occurs. In some cases it will be necessary to wash out the stomach by means of a stomach-tube. The bowels should be evacuated thoroughly by means of some mild purgative, and probably for this purpose there is no drug so useful as calomel. It has been our experience that this agent can be given with much better effect in small doses repeated at short intervals until the desired action is obtained. A useful formula is the following:

℞. Hydrarg. chlorid. mite, ... gr. iij
Pulv. ipecac., ... gr. vj
Sodii bicarb., ... ʒ ij.
M. et div. chart. No. xxx.
SIG.—One powder every hour until the stools change to normal color.

It is often good practice, after having used these powders for twelve hours, to administer a dram or two of castor oil. Young children often take this agent remarkably well; when, however, the child objects to taking it, the oil may be sandwiched between two thin layers of some tart jelly, or it may be given with a few drops of whisky, or floating on iced water. In older children any of the formulas given below may be found useful:

℞. Hydrarg. chlorid. mite, ... gr. ii–v
Sodii bicarb., ... gr. xii–xxx.
M. et div. chart. No. viii.
SIG.—One powder every two hours until the bowels are freely evacuated. For a child from two to four years old.

℞. Sodii et potassii tartratis, ... gr. xx–xl
Sodii bicarb., ... gr. iii–vj.
M. et div. chart. No. vi.
SIG.—One powder to be given in a wineglassful of hot water every hour or two until the bowels are freely evacuated.

℞. Hydrarg. cum creta, ... gr. vi–viij
Sodii bicarb., ... gr. viii–x
Pulv. rhei comp., ... gr. xij.
M. et div. chart. No. iv.
SIG.—One to be given every two hours until the bowels are emptied.

The intestinal antiseptics, such as salol, beta-naphthol, and naphthalene, given in doses suitable for the age of the child, are very useful. Beta-naphthol bismuth, in doses of from one to five grains, according to the age of the child, and repeated every three or four hours, has given good results. When the vomiting is persistent, minute doses of calomel mixed with bicarbonate of soda or triturated with sugar of milk are very beneficial. Small doses of $\frac{1}{10}$ of a grain of calomel combined with from $\frac{1}{500}$ to $\frac{1}{200}$ of a grain of arsenite of copper have, in our experience, worked admirably in checking several cases of severe vomiting. When the vomiting continues for some time after the stomach is empty or immediately follows the taking of food, from one to five drops of tincture of nux vomica, given just before feeding, will often stop further trouble. Small doses of sulphate of magnesium have been recommended by Stuart Patterson in the treatment of this condition. When the attack involves the intestines, the accompanying diarrhea is best treated by rectal injections of a pint or a pint and a half of cool sterilized

water containing one of the intestinal antiseptics. A useful formula is the following:

℞. Bismuth. subnit.,
Salol,
Sodii bicarb., ... aa gr. v.
M. SIG.—The entire powder to be used at an injection. These should be repeated from one to three times a day, according to the severity of the case.

Injections into the bowel of a sterilized 1 per cent. solution of chlorid of sodium are particularly useful, and can be relied on for most cases. Of the greatest importance in acute gastritis is the regulation of the diet; during the attack the stomach should be allowed absolute rest, no food being given. In bottle-fed babies, particularly during the summer months, milk and all articles containing milk should be omitted. For the first twenty-four to thirty-six hours the infant should receive nothing but cold sterilized water in quantities of from half an ounce to an ounce every three or four hours, slowly administered. This water may contain about twenty or thirty drops of good whisky or brandy. When the vomiting and diarrhea have ceased, the child may receive small quantities of some good beef-extract or thin, strained broth. Barley-water or rice-water may also be allowed in small portions. When meat extracts can not be borne by the stomach, albumin water, made by mixing the whites of two fresh eggs in a glass of water and having in it a little salt, will sometimes do very well, and occasionally koumiss is well retained by older children. For the latter the diet should consist of thin broths, and when the intestines are not involved, small quantities of starchy foods may be allowed. When fever is present, the child should be occasionally sponged with cool water containing alcohol or ammonia. The customary diet of the child should be resumed by degrees. Many children recover much faster if they are sent to the country, or particularly to the seashore. Frequently even the change of a visit to the house of some relative near by will prove beneficial.

CHRONIC GASTRITIS.

Synonyms.—CHRONIC GLANDULAR GASTRITIS; CHRONIC VOMITING.

This disease consists in a chronic inflammation of the mucous membrane lining the stomach, attended by hyperemia and thickening of the mucosa, giving rise to a decrease both in the quantity and quality of the true glandular secretion of the stomach, the gastric juice. As a result of the chronic catarrh

large quantities of adherent mucus of a strongly alkaline reaction are formed. This results in an enfeeblement of the digestive powers of the stomach, which, in turn, frequently causes retention of food and consequent fermentation.

Varieties.—Chronic infantile gastric catarrh; chronic gastro-enteritis.

Causes.—A very common cause is the continuation of an attack of acute gastric catarrh, the treatment of which has been neglected. The too hasty mastication of food, eating at too frequent intervals, a diet unsuitable for the child, such as very rich, improperly cooked, or highly seasoned foods; the continued used of candy, cakes, fried foods, or hot breads; general bad hygiene, uncleanliness, and the constant use of starchy foods or those containing too large an amount of sugar are frequent causes of chronic gastritis in infants. As predisposing causes we have syphilis, rachitis, scrofula, and a low degree of inherent vitality. Diseases of the heart, lungs, liver, and kidneys may also act as predisposing causes.

The repeated swallowing of infected discharges from ulcerations in the mouth, throat, or nose, or the mucus from chronic nasopharyngeal catarrh, and carious teeth may also act as causes.

Pathology.—The pathologic changes in chronic gastritis are of the same nature as those in the acute form. The mucous membrane becomes thicker as the disease progresses, its color turns grayish, with deeply injected areas. The whole membrane is covered with patches of dense, sticky mucus. Throughout the whole mucosa, but particularly in the region of the pylorus, we find small papillary projections, caused by the hypertrophy of the mucous membrane. This condition is sometimes known as *etat mamelloné*, and may, in very bad cases, advance to such an extent as to produce absolute polypoid growth. The gland-cells may be destroyed in patches, rendering the differentiation between the principal and parietal cells impossible. If the disease progresses, an infiltration of small cells takes place, with loosening and separation of the superficial layer of the epithelium. According to Ewald, there is a mucoid transformation of the cells of the tubules, which may extend to the base of the gland. In very advanced cases there is a progressive fatty degeneration of the cells, finally ending in an acute atrophy of the mucous membrane.

Symptoms.—The attack is usually a simple continuation of the symptoms of acute gastritis. The vomiting at first is of the contents of the stomach, then of sour, bile-stained mucus, and, finally, when this symptom continues, there will be simply an

ejection of clear, watery fluid, sour smelling and tasting, frequently mixed with fragments of food. Vomiting is increased after the taking of food, and in young infants particularly after the ingestion of farinaceous foods. Vague feelings of distress and pain are felt, referred to the abdomen, the infant generally lying with its legs drawn up. The abdomen itself is usually distended and distinctly tender to the touch. As a general rule the bowels are constipated, although there may be occasional short attacks of diarrhea, during which considerable quantities of mucus are passed. Eructations of gas are common, particularly after feeding. The tongue is coated, this coating being greatest at the back and center of the organ. The papillæ are enlarged and the edges and tip are of a bright glazed red.

The skin in children suffering from chronic gastritis is dry and scurfy; this symptom is particularly noticeable on the surface of the scalp. Various irregular forms of skin eruptions may appear. Several of the forms of stomatitis are not rare, the parasitic variety being that most commonly met. The general condition of these patients is poor, and their appearance is that of chronic ill health. They are thin, pale, with sunken eyes, depressed fontanels, and, when the disease is prolonged, show the characteristic angular face of marasmus. Under the eyes and around the mouth will be seen the blue line so common in chronic affections of the digestive organs. The appetite is generally poor, although it is not at all uncommon for a child who has refused food when offered at the proper times to ask eagerly for all sorts of odd articles of diet between meals and at night. These children sleep poorly; at night they are often disturbed by frightful dreams, from which they start wildly and cry out; incontinence of urine is very common. Frontal headache is a frequent symptom, and choreic movements not seldom occur. Otitis media and abscess of the middle ear may occur. Cases of apparent loss of consciousness and symptoms resembling petit mal due to chronic gastritis have been reported. Attacks of irregular heart action are very frequently met, but this symptom appears chiefly in older children. These children seem to be continually deficient in bodily heat, have cold feet and hands, which, unless they are continually surrounded by external warmth, feel to them icy cold. From various reflex irritations we may have a dry, hacking, or, as is occasionally heard, a loud, ringing cough, somewhat paroxysmal in character and increased at night or after taking some article of indigestible food. Various intestinal irritations simulating worms may also be present. Occasionally a slight rise of temperature is noticed in the afternoons.

Diagnosis.—The diagnosis is founded on the long continuance of the disease, the chronically disturbed digestion, bad nutrition, and the exclusion of organic diseases of the heart, lungs, and kidney. The disease with which it is most likely to be confounded is tuberculosis, especially when the latter has reached an advanced stage; but in tuberculosis we have involvement of the lungs, and a greater and more constant rise of temperature. The abdomen, too, of a tuberculous patient is apt to be sunken; the finding of the bacillus tuberculosis in any of the discharges would settle the diagnosis.

From syphilis it can be differentiated by the fact that in specific disease we have the characteristic eruptions and many other symptoms of this affection. In any doubtful case the application of antisyphilitic remedies may settle the question of the diagnosis. Typhoid fever can be differentiated by the character of the stools in the latter disease, the fact that young infants are not very susceptible to typhoid fever, the characteristic temperature range, and the greater severity of the attack. Widal's blood test will conclusively prove the diagnosis of typhoid fever.

Prognosis.—Under proper diet, care, and hygienic surroundings the outlook for children affected with chronic gastritis is fairly good. The prognosis is rather worse during the teething period, particularly if this occurs during the summer months. It should not be forgotten that while chronic inflammation of the stomach is not often fatal itself, yet it so lowers the vitality of the child as to render it an easy prey to other diseases.

Treatment.—The first indication of treatment is carefully to regulate the diet, feeding the child at as regular intervals as possible, and far enough apart to give the stomach a period of absolute rest between them. Of scarcely less importance are the general hygienic surroundings of the child, its bath, clothing, and general mode of life. In selecting a diet for these cases we must pick out one which will adapt itself to the portion of the digestive tract which is the healthiest. Infants who have been fed on farinaceous foods or condensed milk, those who have nursed from the breast of an unhealthy mother, or who have been given the breast at irregular intervals, so that their stomachs are kept in a continually overloaded condition, should have their diet strictly regulated. Infants who have been fed on artificial foods should be placed on a diet of modified milk, the formula of which may have to be changed many times; or, if that disagrees, they should be fed on small and carefully regulated quantities of animal broths or extracts or predigested milk. Breast-fed babies should be nursed at exact intervals of from two and one-half to three hours,

and between these periods no food whatever should be given. In older children a carefully prepared bill of fare should be directed by the physician each day. This diet-list (best written down) should carefully avoid all rich or highly seasoned foods or a great variety, although a certain amount of change in diet is as important to a child as it is to an adult. The particular kind of food must be selected by the physician for each individual case, for it is impossible to give definite rules as to the diet proper for these children. It is of importance, however, that the heaviest meal should be given in the middle of the day, and that a very light supper, consisting of crackers and warm milk or a small quantity of thin strained broth, should be eaten at night. The last meal should be taken not less than an hour before retiring. For more careful directions as to the feeding of these children the reader is referred to the chapter on the preparation of foods. These patients should be kept as much as possible in the open air; although they do well in the country, yet the sea-shore is decidedly the best place for them. It is of considerable importance in selecting a place for their convalescence that one be chosen where the drainage is at least fairly good. On account of the hyperesthetic nervous condition which almost always accompanies chronic digestive diseases of all kinds, these patients should be kept as much as possible from frights and nervous shocks. They should not be put to school too early, or subjected to the long-continued hours of study which children usually have to undergo. The daily bath is a matter of considerable importance. Each night and morning the patient should be sponged off with water at a temperature of about 86° F. (30° C.). Sponge-baths of sea-water or water containing rock-salt are of great value. Wiederhofer recommends that as soon as a child is out of bed in the morning it should receive a good rubbing with a rough towel. It should then stand in the bath, which contains warm water three or four inches in depth, and be sponged down as quickly as possible with cool salt water, and a half a gallon of the same be emptied over the chest and shoulders. The child should again be rubbed dry until the skin is well reddened. Long hours of sleep are of the utmost importance to these patients. Massage of the abdomen and the application of faradic electricity are extremely useful adjuncts in the treatment.

The indications for medicinal treatment are, first, to rid, as far as possible, the mucous membrane of the adherent mucus which covers it, and then to stimulate it to a secretion of healthy gastric juice. In order to accomplish the former the practice of wash-

ing out the stomach by means of a stomach-tube and funnel is of the greatest use, and should be repeated three or four times a week. When this can not be borne, as in cases in which it excites persistent vomiting or when organic, cardiac, or pulmonary disease exists, lavage may be substituted by warm alkaline drinks or small quantities of alkaline mineral water. Calomel in these cases is a remedy of great usefulness; small doses may be given in combination with bicarbonate of soda. Potassiotartrate of soda, or phosphate of soda, given three or four times a day has peculiar tonic value. When diarrhea occurs, calomel with salol or beta-naphthol bismuth may be used. In some cases the sulphate of magnesia is highly recommended to relieve the constipation of this disease, and an occasional single dose of castor oil acts happily to cleanse the whole intestine. Hydrochloric and nitrohydrochloric acid in doses suitable to the age of the child are very useful agents. The various bitter tonics, such as nux vomica, gentian, or quassia, are valuable in these cases.

CYCLIC VOMITING.

Cyclic vomiting is a condition occurring most often in children of gouty or neurotic tendencies, and is characterized by periodic and recurring attacks of severe vomiting. The attack does not necessarily follow acute indigestion, but is accompanied by deficient excretion of uric acid and followed by severe prostration, from which the patient rapidly recovers.

Causes.—The direct exciting cause has not been discovered, but it seems to be associated with a general derangement of nutrition and assimilation. At the present time it is commonly classed as a gastric neurosis allied to migraine. Exhaustion, fatigue, overstudy, or overwork seem to act as predisposing causes.

The attacks, which recur at intervals varying from a week to several months, are usually preceded by a prodromal stage lasting from twelve to twenty-four hours. During this period the child will be languid and dull, with loss of appetite, occasionally constipation, and a sense of general discomfort in the epigastrium. The temperature is usually elevated, and in Holt's cases reached 103° F. (39.4° C.). The excretion of uric acid is considerably under normal. At the end of the prodromal stage the child is suddenly seized with vomiting, at first after taking food or drink, but soon the vomiting becomes almost constant, or in some cases there may be an interval of a half hour or so; it is accompanied by great retching and distress. The vomited matter consists of frothy mucus and serum, which may occa-

sionally be blood-streaked. The reaction is highly acid. After the beginning of the vomiting the temperature falls considerably. From the severe vomiting the child becomes exhausted to a degree which may excite alarm; the pulse is rapid, weak, and sometimes irregular. No distention of the abdomen usually exists. As the attack draws to a close the vomiting becomes less frequent and severe and the patient gradually recovers—indeed, at the end of the period the child is often better than before the attack began.

Diagnosis.—Cyclic vomiting may be differentiated from acute indigestion by the fact that in cyclic vomiting the attacks are not brought on by indigestible food and by the persistence of the vomiting. From gastritis it can be distinguished by its short duration and self-limited course. The diagnosis between cyclic vomiting and that of organic disease of the kidneys must be founded on a careful study of the urine. Meningitis should be differentiated by the fact that the general history of the two diseases differs. In cyclic vomiting there is a history of repeated attacks occurring over a considerable period of time.

Treatment.—When the patient is seen during the preliminary stage, free purgation by calomel may have a good effect. During the attack medicines appear to be of little use. The chief indication seems to be to prevent their recurrence, and on general principles as much exercise in the open air as possible should be secured. Too long hours of school and overstudy generally should be forbidden. The diet should be carefully regulated, allowing a minimum of meats and a considerable quantity of fruits, either fresh or stewed, and simple farinaceous foods. During the intervals between the attacks the antilithic course recommended by Rachford may be employed.

PYLORIC HYPERTROPHY WITH STENOSIS.

Congenital hypertrophy of the pyloric end of the stomach with stenosis of the pylorus itself is a rare condition. Several cases have, however, been recently reported. The cause of the stenosis is usually a congenital malformation of the pylorus or the pyloric end of the stomach. The muscular coats of the parts affected are hypertrophied, and there is frequently a hyperplasia of the mucous and submucous tissues.

Symptoms.—The symptoms may appear immediately after birth, or when the child is from one to five weeks old. The child is usually restless, desiring drink, but attempts at swallowing are soon followed by vomiting. Occasionally at first the vomiting

occurs at long intervals, but rapidly increases in frequency until it follows all attempts at swallowing. The vomited matter consists of the materials swallowed, together with a moderate amount of mucus, but is never bile-stained. The tongue is clean. The bowels may not be affected so far as regularity of movement is concerned; the stools are, however, small. Nutrition rapidly fails, and the child usually dies of inanition. It is well to remember that although stenosis of the pylorus is a rare condition, its presence should be suspected in cases of persistent and increasing attacks of vomiting following the taking of fluids in young children, especially if the vomited matter contains no bile and the tongue is clean.

Treatment.—The first indication in the treatment is the careful regulation of the feeding. The amount of food should be small, and must be given at frequent regular intervals. It should be of such a character as to be easily and quickly digested. No refuse food should be allowed to accumulate, for it must be remembered that pyloric stenosis is an occasional cause of gastric dilatation, and to prevent this the stomach should be emptied by irrigation and washed out once or twice daily. Vomiting, when it occurs, is generally regarded as salutary, and unless it becomes very severe, no effort should be made to check it. If no food can be retained and nutrition fails, surgical methods must be considered. Meltzer, of New York, recommends that in these cases a typical pylorectomy be performed.

ULCER OF THE STOMACH IN CHILDREN.

Gastric ulcer is rare before puberty, though not uncommon after that period. Among the cases reported and confirmed by autopsy a certain number are described as simple perforating ulcers, but a close scrutiny of these, as pointed out by Soltau Fenwick, were in reality secondary to definite conditions competent to produce them. Several varieties are described, such as hemorrhagic erosion, follicular ulceration, simple ulceration, acute and chronic, and tubercular and malignant ulceration.

Occasionally cases of aggravated gastric disturbance are met in infants and young children, accompanied by symptoms arousing grave suspicion of ulceration, which get well and the diagnosis can not be confirmed. Some, again, are not suspected at the time to be cases of gastric ulcer, but a grave anemia or spanemia sets in that can only be accounted for by a rapid loss of blood, and presumably from the stomach, in the absence of evidence pointing to loss from any other source.

Causes.—The age at which ulceration of the stomach has been found ranges gradually all the way from a few hours after birth to a few days, and thence to the period when childhood merges into youth, after which the disease is much more frequent. Conditions which predispose to ulceration of the stomach are those which lower the integrity of the blood or its proper distribution and depuration, and follow upon many diseases, such as septicemia, scurvy, purpura, hemophilia, and leukocythemia. In these cases effusion of blood into the gastric mucous membrane may be followed by tissue-necrosis. Next comes the persistence of acute catarrh of the stomach, rendering the tissues more vulnerable to local or systemic disturbances. Mere mechanical irritation of these tissues alone is not capable of producing ulceration; it is usually necessary to assume a lowered state of vitality, local or general or both, in order that other causes may become operable.

Acute infectious diseases, such as typhoid fever, diphtheria, variola, and pneumonia, are frequently followed in adults by gastric ulceration, and this obtains to a less extent in children. This is true also of burns of the surface, probably due to resultant hemorrhages into the gastric mucosa which become converted into areas of necrosis.

As previously stated, abrasions of the mucous membrane of the stomach tend to heal readily and promptly when once the cause of irritation is removed and rest is secured.

Several causes, local and systemic, conspire to delay healing. Among the local causes which prevent repair, the anatomic situation of the lesion is a highly important one. Acute ulceration of the stomach is almost always found in the cardiac or middle zone, near the greater curvature; a few instances have been found in which it occurred near the lesser curvature, which is the common situation of chronic ulcer in adults.

The delay in the healing of injuries in or near the pyloric region is chiefly due to want of rest, as this is the area of greatest muscular activity of the viscus and is practically uncontrollable. Again, the structural relationships of the pyloric region are such as to interfere with healing. There the submucous connective tissue is scanty and firmly binds the surface to the subjacent tissues.

In the pyloric region, again, the blood supply is deficient and irregular, presenting unfavorable conditions for prompt repair. The greatest circulatory, hence functional, activity is in and about the fundus and central portions of the viscus.

If hyperchlorhydria exists, this also tends to delay repair.

Among the systemic causes of delayed healing those first to be considered and removed are morbid states of the blood. Well-marked anemias, from whatever causes, the cachexiæ resulting from syphilis, malaria, or tuberculosis, or the hemic disorganization following upon the acute infectious fevers obviously inhibit cellular repair. Tubercular ulceration is not demonstrated to be a common condition, although various grades of gastric and intestinal ulceration are sometimes seen in tuberculous individuals. Encysted collections of pus arising from tubercular peritonitis and caseous lymphatic glands which discharged into the stomach have been demonstrated. Malignant diseases of the stomach are extremely rare in children.

Symptoms.—In young children the most prominent and usually the earliest indication of gastric ulcer is the vomiting of blood; in them subjective symptoms can not be accurately nor readily interpreted. It should be borne in mind that this may arise from other causes, as from lesions in the nose or mouth. It may be a bright arterial blood which is rejected or blackened by the action of the gastric secretions on the hemoglobin.

In older children the phenomena are usually those of so-called "dyspepsia" or "indigestion," until evidences of a profound anemia or collapse supervene and death follows, when the lesion is exhibited at autopsy. To these may be added hematemesis, pain, acute or dull, or varying degrees of tenderness on pressure. Pain after a meal is not, as a rule, so pronounced as in adults, but occurs and may be severe. Relief is found in vomiting. The location of pain may be in the epigastrium or the back, near the last dorsal or first lumbar vertebra. In most cases there is pain or tenderness or both over the ensiform cartilage, pressure on which induces nausea or vomiting.

Vomiting is a variable symptom, and is generally preceded by nausea, occurring as the culmination of a painful crisis and followed by relief of abdominal pain. Hematemesis, always suggestive of gastric ulcer, is, however, not pathognomonic of that disorder. It may arise from fissured nipples of the mother, lesions in the mouth, pharynx, or nose of the child; it often follows paroxysms of whooping-cough, and occasionally complicates measles and variola. In diseases of the blood, as scurvy, purpura, and hemophilia, it is often a prominent feature.

When the vomiting of blood does accompany ulceration of the stomach, the amount rejected is no index of the extent of the eroded surface. If of considerable amount, it is usually of a bright arterial color and indicates that a large vessel is eroded. Lesser bleedings are followed by darker material

(melena), evidently slower hemorrhage, and the alterative action upon the hemorrhage by the gastric juices.

It must not be overlooked that bleeding of a most destructive nature may go on after the hematemesis has ceased, owing to the lessened reflex activity due to nervous depression. After death from this cause the stomach has been found filled with blood. Hemorrhage from the bowel usually accompanies that from the stomach and may replace it, by producing what is called spurious hematemesis, the blood being forced upward from the intestine and thence rejected by the stomach. This may arise from many other conditions besides gastric ulcer, and is especially puzzling when forced up into the stomach, as when it occurs in cases of intussusception, hemorrhoids, and rectal congestions.

The evidences of intestinal hemorrhage are profound pallor and collapse, followed by evacuations containing blood. In gastric ulcer the bowels are usually confined, the stools very hard, scybalous, and covered with thick tenacious mucus; there is rarely flatulence, but often acid eructations. Perforation is a much-to-be-dreaded complication.

Treatment.—Ulceration of the stomach is often first manifested by hematemesis, and if so, the treatment of that symptom is urgently demanded. Again, the evidences of bleeding may be only sudden pallor and collapse, and remedies must be directed toward the checking of hemorrhage along with the prompt supply of intravascular fluids, among which intravenous or intracellular saline injections stand first in order.

The earliest conclusive symptoms are epigastric pain and great tenderness. These must be relieved, and among the efficacious agents opium is not the best, because it is excreted by the glands of the stomach, is a more or less dangerous drug to children, and may itself cause nausea and vomiting. There is almost invariably present a certain amount of chronic gastric catarrh, certainly in those beyond the earliest infancy; hence a careful treatment of this state will tend to limit the ulcerative process and place whatever lesion exists in the gastric mucosa in a condition for repair.

In chronic gastric catarrh the stomach often presents loss of motor activity, and therefore food remains unduly long in that organ; mucus is apt to be overabundant, viscid, tough, and adherent, drowning and delaying the action of the normal secretions and encouraging fermentation. The reaction of the contents is acid, chiefly from the products of fermentation, and will show lactic, acetic, butyric, and other volatile fatty acids, while the normal hydrochloric acid is usually markedly deficient. The

lab-ferment and pepsin are almost invariably present, although deficient in quantity.

Irrigation will remove the mucus, the offensive and irritating fatty acids, and the undigested food, and will encourage the secretion of hydrochloric acid, thereby quieting the reflex disturbances and pain and producing comfort. Vomiting accomplishes these results very slowly and imperfectly.

The addition of an alkali to the sterile water in lavage is often important at first, and at a later irrigation bismuth may be used: first the alkaline solution is to be siphoned out, and immediately the bismuth in water run in and out. In this way a complete cleansing and neutralizing effect is secured, and thus an excess of alkali and bismuth can be used which is at once removed and does not remain in the intestines, as would be the case if swallowed.

If the irrigating fluid should at any time bring away blood, especially after the earlier washings, or when other evidence exists of open lesions, it may be necessary to employ an astringent, such as alumnol, silver nitrate or albuminate, or some preparation of the vegetable astringents, such as gallic acid. These solutions should always be thoroughly removed immediately by washing; in the case of silver nitrate, by a solution of sodium chlorid. For the relief of pain and tenderness the lavage of alternate hot and cold water often suffices; or orthoform may be added to the solution. Chloretone is worthy of trial, either by lavage or administration by the mouth. Cocain and morphin, though of great efficacy, must be employed with caution.

One of the most efficacious drugs for the relief of gastric pain is the rectal injection of strontium bromid, as first recommended and used by D. D. Stewart. Small blisters over the epigastrium have been recommended for controlling the pain and nausea of the chronic form, but they have proved disappointing. The use of a moist pad over the abdomen, such as the Pressnitz bandage, is more helpful.

It is, of course, wise to give the stomach no labor for several days, and feeding by the rectum or colon will readily accomplish ample support for a very long period. Leube's pancreatic emulsion is excellent for this; somatose, beef-extracts, eggs, and predigested milk may be used alternately or as needed. In an adult one of the authors has seen the stomach thus relieved for over three weeks at a stretch, and in children from a week to ten days.

Great care is needed in returning to diet by the mouth, which at first should be in the form of peptonized milk or peptonized

milk-gruel, given in small quantities at moderately frequent intervals.

The introduction of the stomach-tube in children is not difficult, and rarely causes any trouble. It is best done when the child lies on its side. It is thus largely employed in the acute milk infections, summer complaints, etc., in our dispensaries, and has seldom caused us any anxiety.

Endless remedies have been advocated, such as turpentine, chlorodyne, etc., but few drugs have given us satisfaction except those mentioned. A word should be said about bismuth salts. These are of value in proportion as they are mechanically good, the degree of comminution being of more importance than the chemic preparation. For lavage the best is bismuth subnitrate. If fermentation is a marked feature, the subgallate is better for internal administration. Hydrastinin hydrochlorate is the best vasoconstrictor we have used, and will check bleeding better than ergot, or it may be combined with the latter in the proportion of $\frac{1}{10}$ to $\frac{1}{4}$ grain of hydrastinin hydrochlorate to $\frac{1}{4}$ to 2 grains ergotin.

GASTRALGIA.

Definition.—The term gastralgia is applied to a sudden, severe attack of pain in the gastric region unaccompanied by inflammation.

Causes.—The condition may arise from exposure to cold, by taking cold drinks, especially when the child is overheated, or occasionally by getting the feet wet. Not infrequently it appears as a form of neuralgia. Holt states that it is common in children affected with malaria, especially at the onset of the attack. The amount of pain may be slight, or may be so severe as to cause faintness or marked prostration. No inflammatory symptoms accompany the pain.

Treatment.—The patient should be put at rest in bed, and counterirritation over the stomach applied by means of a turpentine stupe, mustard plaster, or hot-water bag. Internally should be given moderate quantities of hot water containing five drops of spirits of chloroform, Hoffmann's anodyne, brandy, whisky, or gin. If the pain is severe enough to cause prostration, heat should be applied to the body and all food withheld during the attack. Recurrent cases are best treated by the use of arsenic in the form of Fowler's solution. Attention should also be directed to the patient's general health and to careful regulation of the digestion.

DILATATION OF THE STOMACH.

Frequently the stomach becomes dilated as the result of long-continued chronic catarrh of its mucous membrane. The condition is most commonly found in artificially fed rachitic or anemic children. Occasionally it arises from acute gastro-enteritis and cholera infantum. It is also seen as a secondary consequence of congenital stenosis of the pylorus or obstruction of the duodenum and ileum. (See article on this subject.)

Pathology.—As a result of weakness and insufficiency of the digestive fluids decomposition of the casein of milk and all starchy elements takes place, resulting in the formation of large quantities of gas. These keep the weakened muscular coats continually on the stretch, and, as a result, atrophy of the muscular fibers and glands takes place; such a stomach is never entirely emptied, but always contains more or less decomposing food and mucus, from which often results an autointoxication. The size of the stomach in this condition is sometimes very great. Thus, Henschel records the case of the stomach of an infant two weeks old the capacity of which was 190 c.c., the normal capacity being 70 c.c., and he also gives an account of the stomach of an infant of three months whose gastric capacity was 485 c.c., the normal capacity being 150 c.c. Other cases showing the great increase in size of the stomach owing to dilatation are reported by the same author and others.

Symptoms.—The symptoms of gastric dilatation are frequently vague, and it is not uncommon for the condition to be discovered only at the autopsy. Such symptoms as chronic dyspepsia, regularly occurring discomfort after taking food, and habitual vomiting after meals may lead us to suspect the condition. The child complains of pain after eating for some days, and then suddenly vomits large quantities of partially digested fermented curds or the remains of other food taken during this time. The tongue is heavily coated, there is frequently constipation, and the child shows symptoms of general nutritional failure.

Diagnosis.—Owing to the obscurity of the symptoms the diagnosis may not be easy. Sometimes the dilated stomach may be mapped out by percussion, but should the large intestine also be distended, this method of diagnosis in a child is by no means an easy matter; in fact in the majority of cases it is impossible, as the tympanitic percussion-note would be the same over both. It is said that a splashing sound may occasionally be produced

by shaking the child gently, but this sound can only be heard when the stomach is full of fluid.

Treatment.—The treatment is that of chronic gastric indigestion. The food should be carefully modified and given in small quantities at regular intervals. Irrigation of the stomach is especially indicated. Strychnin or nux vomica, arsenic, and the mineral acids, particularly hydrochloric, are the chief remedies to be employed. Such children should be kept in the best of hygienic surroundings and allowed a life in the open air as much as possible.

DISEASES OF THE INTESTINES.

MALFORMATIONS OF THE INTESTINAL TRACT.

Stenosis and Atresia.

Narrowing or closure may occur at any part of the intestinal tract. The causes may be divided into congenital and acquired. The congenital form is usually due to the formation of cicatrices resulting from intestinal ulcer occurring during intra-uterine life. The condition may also arise from the formation of peritoneal bands or tumors arising during intra-uterine life. The acquired form may be caused by chronic intestinal ulcerations or mechanical irritation of the intestines arising during the course of dysentery or certain forms of chronic diarrhea. Occasionally the rectum ends in a blind pouch without the formation of the anal opening. In this condition the rectum may terminate at any point below the sigmoid flexure. In some cases it is attached directly to the floor of the perineum, producing a tumor of the latter as the meconium collects and distends the blind end of the bowel.

Treatment.—Immediately following birth the physician should examine the infant to see if the parts around the anus are properly formed. Ordinarily, soon after it is born the child has a free passage of meconium; if this does not occur, examination of the rectum ought to be made with the finger, and should any malformation be found, it will probably be necessary to use surgical means for the relief of the condition. In cases where the rectum ends in a blind extremity which is near to the surface of the perineum, the intervening partition can be broken through by means of a grooved director, and an opening made with the finger. If a considerable amount of tissue lies between the surface and the rectum, it will be necessary to dissect systematically

upward in search of the rectal opening. In doing this a staff should be placed in the bladder as a guide. Should this fail, Rotch advises that Littré's operation be performed. This consists in opening the sigmoid flexure in the inguinal region and making an artificial anus; or an attempt may be made to cut through the sacrum and make an opening into the gut at this point.

ACUTE ENTERITIS.

Synonyms.—Acute Intestinal Indigestion; Acute Catarrhal Enteritis; Simple Diarrhea; Mechanical Diarrhea.

Causes.—Food given in too large quantities or of a sort not adapted to the age and condition of the child, irregular feeding, the use of a dirty nursing-bottle, the too early and frequent use of table foods, and bad hygiene may be accepted as the most usual causes of acute enteritis. Any or all of these causes may increase the severity of the attacks when they occur during the period of dentition, at which time the entire nervous system of the child is readily influenced by external causes, and the digestive tract is in a condition which may be termed hyperesthetic. Another predisposing cause may be sudden changes of the temperature, especially a rapid change from cool weather to hot.

Symptoms.—The attack of enteritis usually begins with an increased number of stools, averaging anywhere from five to twenty a day. The bowel movements, which for the first two or three evacuations are normal in color and consistency, rapidly change to liquid or soft unformed masses of a greenish or yellowish hue. All the bowel movements contain curds and more or less mucus; later they may be streaked with blood. The evacuations are preceded by pain and tenesmus. In a few hours the child suffers some loss of flesh, which is particularly manifest in the face and limbs. When the attack is of short duration, the abdomen may be painless on pressure, but as a general rule the child will complain of some pain in this region on palpation in a few hours if the attack continues. Vomiting may or may not be present. Occasionally the disease is ushered in by convulsions, but this symptom shows a severe degree of intestinal irritation or poisoning. Thirst is nearly always a prominent feature. More or less distention of the abdomen is usually found during the first hours of the disease. The pulse, although increased in frequency during the attacks of pain, is not usually much above normal. If fever is present, it is rarely

constant, but some irregular increase of temperature is generally observed.

Prognosis.—The prognosis is favorable under proper treatment. The principal danger consists in allowing the irritating masses of food to remain in the intestines long enough to set up a condition of chronic inflammation.

Treatment.—When the case is seen early, a dose or two of a dram of castor oil will, in many cases, remove the irritating masses of undigested foods. When the child is old enough, this may be given in the form of a soft capsule, each one containing from five to ten drops of oil. In young children the remedy may be given in emulsion or sandwiched between two layers of five or ten drops of whisky or brandy, or the oil may be introduced into the rectum. Calomel is indicated in these cases; it may be either given alone or preferably in combination with salol or bismuth. An effective mixture used by us in hundreds of dispensary cases consists of equal parts of lime-water and cinnamon water, of which two drams are given every hour or two, and often three grains of bismuth subgallate are added. Where calomel is used in these cases, the drug acts not only by its laxative effect, but also by increasing the flow of bile into the intestines. When the amount of pain is very great, the aromatic syrup of rhubarb, in doses of from a dram to half an ounce, will be found useful. Occasionally a few drops of camphorated tincture of opium may be combined with any of the before-mentioned agents to relieve pain. It should be distinctly understood, however, that the use of opiates in cases of acute indigestion is not to be encouraged, nor are astringents to be given until the intestine has been thoroughly cleansed of the irritating cause of the attack. In most cases the thorough evacuation of the intestines should be encouraged by copious enemata of boiled water containing a small amount of Castile soap, ten or fifteen grains of bismuth subnitrate, or 1 per cent. of sodium chlorid.

The diet is a matter of great consideration. When the child has been fed by the bottle, all milk, or preparations containing it, should be stopped until the bowel movements regain their normal character. During the first six or eight hours of the time during which milk diet is withheld the patient should receive small quantities of sterilized water containing fifteen or twenty drops of brandy every two or three hours. At the end of this time it is our custom to give the child a teaspoonful of egg-water, made by gently stirring the whites of two eggs in a half pint of water and adding a pinch of salt, every two hours, or this may be varied by a teaspoonful of freshly pressed beef-juice or liquid peptonoids.

If the child needs nourishment, it may be fed every hour with the above—one hour with liquid peptonoids, the next with egg-water.

In twenty-four hours after the stools have resumed their normal color the child may be gradually returned to its usual diet; it is well, however, to give the patient a drop or two of tincture of nux vomica three or four times a day before feeding, in order to stimulate the assimilative action of the intestines. Small doses of calomel or bismuth, or a combination of both, should be given for some days after the attack has ceased. A useful formula is the following:

℞. Hydrarg. chlorid. mite, ... gr. ⅛
Bismuth. subnit., ... gr. v.
SIG.—One powder to be given every four hours for five days after the diarrhea has ceased.

We have also found the following to be useful, especially when vomiting is present:

℞. Liq. calcis,
Aq. cinnamomi,
Aq. chloroformi, ... aa ℥j.
SIG.—One dram every ten or fifteen minutes to allay gastric and intestinal irritation and as an antiseptic.

CHRONIC ENTERITIS.

Synonyms.—CHRONIC INTESTINAL INDIGESTION; CHRONIC CATARRHAL ENTERITIS; CHRONIC IRRITATIVE DIARRHEA; CHRONIC INTESTINAL CATARRH; CHRONIC ENTEROCOLITIS.

Causes.—The causes of chronic intestinal catarrh are continuation or return of a series of attacks of acute intestinal indigestion; the continued use of improper foods, especially at the period of dentition. Chronic enteritis may follow any of the infectious diseases, exposure to cold and wet, or bad hygienic surroundings. Chronic intestinal catarrh is fully as common in winter as in summer, although the type seen in the hot months is severer and runs its course quicker than in cold weather. The disease is most commonly seen from the third month to the end of the second year, and is much more frequent in artificially fed children than in those fed from the breast; indeed, providing that syphilis, rickets, or struma is not present, it is somewhat rare to find chronic intestinal catarrh in breast-fed babies. The majority of cases are caused by attempts at feeding a nursing child on a badly prepared artificial food, especially condensed milk or tainted cow's milk.

Symptoms.—The diarrhea that has been present during an acute attack continues, or returns after a period of cessation. The bowel movements are watery, or they may occasionally change to semiformed masses of a grayish-white, putty-like hue and consistence. They contain undigested food and much mucus. Occasionally they are streaked with blood and pus. Green stools are common, and these may last for quite a considerable period, particularly at the beginning of each exacerbation of the disease. The stools are found, on microscopic examination, to contain swarms of bacteria; their odor is offensive and putrid, but rarely do they have the peculiar musty smell of the large, watery passages of true cholera infantum. The number of the stools will usually average from four to ten a day, and are preceded and accompanied by considerable pain and tenesmus. The disease is subject to distinct exacerbations, and it is not infrequent for the medical attendant to imagine that he has the case well under control and later to find, to his discouragement, that the disease has returned with renewed vigor. These cases imperatively require careful attention and patience, not only on the part of the physician, but also on the part of those having charge of the little patient. While a moderate loss of weight is sure to appear finally, and, indeed, may become very great, it is not infrequent to see patients stand the continued drain on the system from diarrhea and lack of assimilation of food remarkably well. The loss of flesh is particularly noticed in the limbs and face, the former losing their roundness of shape and firmness to the touch and the latter its characteristic plumpness and happy expression. The facial expression of these children is remarkably old, thin, and tired. The fontanel is depressed, and the lower part of the face assumes an angular shape which is eminently characteristic. The abdomen is either depressed or considerably swollen; the child is fretful, cries a great deal, and is extremely restless during sleep, young children tossing and frequently crying out, and older children exhibiting the group of symptoms known as night-terrors. The appetite is capricious, sometimes almost lost and at other times the child manifests a ravenous desire for food. Occasional attacks of constipation are not infrequent. The tongue is red, dry, or may be covered by a brownish or yellowish coat. Relaxation and prolapse of the rectum are not uncommon. The skin is often dry and scurfy. The temperature is generally normal, although short periods of slight pyrexia are not infrequently seen. Many of these cases run their course without gastric complications.

Diagnosis.—Although the diagnosis of chronic intestinal

catarrh is by no means difficult, cases presenting the before-mentioned symptoms should be carefully examined before a positive opinion is given. The disease may occasionally be confounded with general tuberculosis with intestinal complications; but in tubercular affections we have the regular daily rise and fall of temperature, the large watery bowel movements, and probably evidences of tubercle in other parts of the body, especially the glands and lungs.

Prognosis.—The prognosis depends in great measure upon the duration of the disease, the general constitutional condition of the child, and the treatment it receives. The coexistence of other diseases, such as syphilis, tuberculosis, rachitis, etc., makes the prognosis more unfavorable. Amid good hygienic surroundings, with careful regulation of the diet and the administration of proper remedies, the prognosis is generally favorable, although the duration of the condition is usually rather tedious.

Treatment.—The success of the treatment of chronic gastro-intestinal catarrh depends far more upon the food and general surroundings of the child, its place of living, its bathing, clothes, etc., than upon the administration of any drugs. In young children nursing from the breast the composition of the milk should be carefully investigated. The existence of pregnancy, prolonged hard work, nervous excitability, prolonged lactation, and many other causes may so alter the constitution of the mother's or nurse's milk as to produce chronic dyspepsia in the child. In such cases, of course, the diet should be regulated, and, if possible, another wet-nurse should be substituted, or, when the child is nursing from the mother's breast, it should be provided either with a wet-nurse or placed on artificial diet. It is extremely difficult to lay down any fixed rule for the diet of these children. The child should be nourished on that class of foods which is most easily digested and assimilated by the strongest part of its digestive tract. In many cases the stools will contain large undigested masses of casein or fat, or they may be highly acid; especially is this the case when the child has been fed on foods rich in lactose. In this class of cases all milk should be prohibited and the child fed for a considerable period on beef peptonoids, panopeptone, meat-extracts, albumin-water, broths, or other species of proteid foods. When the stools are alkaline in reaction, frothy, or putrid, a moderate diet of starchy or dextrinized foods or foods containing some sugar will often answer admirably. It must be borne in mind, however, that, as a general rule, no child under eight months of age will thrive continuously on a diet of starch. Modified milk containing a low proportion of

sugar and fat and a high percentage of proteids is often of great use, and to this should be added 10 or 15 per cent., by bulk, of lime-water. Peptonized milk, either alone or combined with arrow-root, is sometimes of service, but this diet can not be kept up for long. In older children the diet is a matter of the greatest importance, but it is often very difficult for the physician to control and direct it in a satisfactory manner. All irregular meals, highly seasoned foods, candies, and most of the sweet cakes must be strictly prohibited. It is far better that the child should occasionally receive too little food than that it should eat food of improper quality or in quantities too large for its temporary capacity. The following diet-list has been recommended by Starr for these cases, this, however, being subject to modifications and frequent changes.

Breakfast.—At 8 A.M., a teacupful of bread and milk; the milk should be rendered alkaline by the addition of lime-water. In not very severe cases a lightly boiled or poached egg, with one or two slices of bread made from unbolted flour, or stale bread, with butter, may be substituted for the bread and milk.

Dinner.—At noon a lean broiled mutton chop or a piece of underdone tender roast beef; such vegetables as cauliflower or a small quantity of well-roasted potato (not new) may be added. A small quantity of bread well toasted or Zwieback; occasionally a half an ounce of good sherry well diluted.

A 4 P.M. about twelve ounces of fresh milk, rendered alkaline as previously mentioned.

At 7 P.M. supper: a cup of beef-tea or mutton broth.

A diet-list such as the preceding may be continued as long as the child does well. Whenever a relapse occurs, a return to a strict diet of modified milk, or, better, beef-juice, beef-tea, or chicken or mutton broth, given in small quantities at regular intervals, and this plain diet continued until the bowel movements have become normal in color and have been free from mucus for a number of days. The question of the climate and general surroundings of the child is one for earnest consideration. Children with intestinal disease, particularly of a chronic form, do much better in the country than in the city, but they improve more rapidly at the seashore than anywhere else. It is also of importance that such children be kept in the air, and they should be encouraged to play out-of-doors. Even in winter, providing the weather is not too windy or damp, they should be kept in the open air for a considerable portion of each day. The clothing should be of wool, and so constructed as to impede as little as possible the free movement of the limbs.

Medicinal Treatment.—The medicinal treatment should be directed first toward thoroughly clearing the intestinal tract of the irritating cause of the disease, and, secondly, stimulating the digestive and assimilative powers. For the first, laxative doses of castor oil are occasionally of great use. Calomel, also, is an exceedingly useful drug for this purpose. It is best given in small and frequently repeated doses, and may be combined advantageously with salol or bicarbonate or phosphate of sodium. Beta-naphthol bismuth, in doses of from one to five grains repeated every few hours, has been highly recommended by Dr. Lewis Fischer and others. The following prescription is recommended by Rotch:

Podophyllin,	1 grain
Alcohol,	1 dram.

Give from three to five drops, according to the age of the child, repeated morning and evening, the dose to be lessened if it causes more than two discharges a day. Tonics, and particularly arsenic and nux vomica, should be given. From one to five drops of the tincture of nux vomica given immediately after taking food forms an excellent digestive tonic. Of the intestinal astringents, bismuth is probably the best: doses of from five to ten grains of the subgallate, salicylate, or subnitrate, given either alone or in combination with salol, give excellent results. In many cases bismuth may be advantageously administered by means of enemata applied to the lower bowel. Opiates, as a rule, are distinctly contraindicated. Probably one of the most successful methods of treatment is by copious enemata of warm sterilized water or normal salt solution; the latter has been recommended by Fischer, of New York. From three to four quarts of water should be used at each irrigation. They should be given from a fountain syringe, to which is attached a large-sized soft catheter having more than one opening. The child should lie on the nurse's lap, either on its back or in what we have found to be better positions—namely, on the abdomen or left side. The syringe should be held about three feet above the floor, and the water should be allowed to flow in and out again. It is often necessary to flush out the intestines thoroughly with either plain boiled water or normal salt solution, in order to clear them before administering the enema containing the intestinal antiseptic or astringent. Probably the best antiseptic to be given in this way is a combination of subnitrate of bismuth and salol, or beta-naphthol bismuth. They should be administered in a half pint

or so of water, allowed to flow into the intestine, and remain there.

When anemia is a complication of this disease, and especially if it persists after the recovery of the child, some of the numerous preparations of iron are indicated. While, as a rule, cod-liver oil or any of the vegetable oils are contraindicated when administered by the mouth, yet not infrequently we find excellent results following inunctions of these applied to the abdomen or over the body generally. The benefit of these inunctions is undoubtedly increased when accompanied by massage.

ACUTE MILK INFECTION.

Synonyms.—Cholera Infantum; The Term "Choleriform" is Sometimes Used.

The disease here described as acute milk infection is that form of acute intestinal poisoning produced by those bacterial toxins peculiar to milk and foods containing milk.

Acute milk infection is a disease peculiar to the summer months, and is found only in children fed on an artificial diet of foods containing milk. It occurs very rarely in children fed upon breast milk, although occasionally such cases have been reported.

Causes.—The specific poison, bacterial or chemic, producing cholera infantum has not yet been isolated. In the healthy nursing child two forms of bacteria are constantly found in the intestinal tract; these are the bacterium lactis aërogenes and the bacterium coli communis. These are sometimes called the "obligatory milk feces" bacteria. According to the researches of Baginsky, Booker, and others, the upper part of the duodenum is quite free from micro-organisms, while the lower part of the small intestines contains considerable numbers of the bacterium lactis aërogenes. The bacillus coli communis has been found chiefly in the lower part of the ileum, and still more abundantly throughout the entire length of the colon. Whether or not the poison is due to a sudden increase in number of these bacteria or their ptomains, produced partly by the continued high temperature of the summer and aided by a fermentation of artificial foods in the intestines, or whether it is due to some specific microbe which has its existence only during the warmer months, is still an unsettled question. Certain it is, however, that true cholera infantum—acute milk infection—is almost solely found during the summer months. It is a disease much commoner in cities than in the country, and the number of cases increase during the

prevalence of a temperature above 70° F. (21.1° C.). The children of the poor are oftener attacked than those in better circumstances, and, as before stated, it is found almost entirely in children fed on artificial foods containing milk or on unsterilized cow's milk, and some of the very worst cases that we have seen have been among infants fed on condensed milk. It appears most frequently from the third month to the end of the second year. Although the toxic bacteria are most frequently introduced into the system in the manner before stated, they may enter in other ways, as by the anus or by the mouth from the nipple of a mother or nurse whose habits are uncleanly. An infant may infect itself from its own fingers, which in many cases are far from clean.

Pathology.—In infants dying after an acute attack of milk infection of short duration, we find a very considerable amount of emaciation, much more marked in the face, however, than in the body; the cheeks and eyes are sunken, and the fontanel is depressed. If the disease has lasted for some days, the loss of bodily weight is extreme; the limbs lose their rounded shape, and the skin covering the upper part of the thighs is loose and hangs in folds. The face has entirely lost its plumpness and shows extreme emaciation. Upon opening the body, examination will show minute hemorrhages upon the surfaces of the lungs, with evidences of hypostatic congestion at their bases. The same minute hemorrhages are found in the heart, which is usually in a state of diastole, its cavity being filled with blood. The mucous membranes of the stomach and intestines are in a condition of capillary congestion, with small hemorrhagic patches scattered here and there. The contents of the intestines are liquid, from an excessive secretion of mucus. Peyer's patches and the solitary glands are swollen. There is marked congestion of the mucous membrane of the entire large intestine, this being greatest in the cecum and descending colon, throughout which ulcers may be found; these ulcers may be single or multiple, and are of varying depth. In many instances catarrhal pneumonia will complicate the later stages of the disease, and in these cases solidification will be found at the bases of the lungs. According to Ashby and Wright, a microscopic examination of the mucous membrane of the intestines shows a general distention of the network of their capillaries and an exudation of leukocytes. This condition exists in the mucous membrane itself, the submucosa, the villi, and between the tubules and crypts of Lieberkühn. The central portions of the solitary glands are softened, or the softened portion having been dis-

charged, the remains of the glands appear as sharply cut ulcers.

Examination of the brain shows no specific lesion; occasionally the sinuses are found distended with blood, or, on the other hand, a condition of cerebral anemia may exist. Ashby and Wright mention one case in which meningitis was present, but these instances are extremely rare.

Symptoms.—No matter how the poison enters the system, the symptoms of acute milk infection are nearly always the same. Occasionally a mild diarrhea may precede by a few days the sudden onset of the acute indications. During this time the stools are more frequent than normal and are green. There may be some vomiting after taking food. It is very questionable, however, whether this preliminary diarrhea is part of the true attack of cholera infantum. Very frequently the disease begins suddenly at a time when the child is in perfect health. The first symptoms are, then, vomiting and purging. The vomiting is intense and continuous. The vomited matter is first composed of the gastric contents, later of watery detritus, and, finally, after there is nothing left in the stomach to be thrown off, the attempts at vomiting continue. The child has nausea of the most intense character. The vomiting is increased by the taking of food or drink—in fact, anything put into the stomach is immediately expelled. During these paroxysms the child becomes pale, the lips are blue, a dark line is seen around the mouth, and the entire body is covered with cold, clammy sweat. The evacuations of the bowels occur more and more frequently, until they are practically continuous. Their character changes with great rapidity from the normal yellow movement of the infant to a thin, green, spinach-like discharge (decomposed mucus), and finally an almost continual expulsion of large quantities of water mixed with shreds of mucus, which give them somewhat the appearance of rice-water; these discharges have a characteristic musty odor, are acid in reaction, and are composed of serum mixed with epithelial cells and swarming with bacteria. The abdomen in the earlier stages of the disease may be slightly distended and soft, but as the diarrhea continues it becomes retracted. A marked difference exists in the temperature of the surface of the body and of the interior. Occasionally during the first few hours the surface temperature may be above 98.6° F. (37° C.), but in the majority of cases it does not rise above the normal point. In the algid state of extreme depression it is distinctly subnormal. The rectal temperature will be found to be anywhere between 103° and 107° F. (39.4° to 41.6° C.). The average duration of

the disease is from one to three days, although we have seen cases in which the entire attack, from the first symptoms until the death of the child, has lasted but six hours. The loss of flesh is appalling, the child frequently changing in the course of a few hours from a rosy, plump baby to a mere skeleton covered with skin. There is probably no other disease, with the exception of Asiatic cholera, in which the emaciation is so extreme in so short a time. This rapid decline in bodily weight is due to destructive loss of fluids. As the disease progresses the respirations become shallow and jerky, and the child passes into a state of coma, convulsions, or, rarely, delirium. It is not unusual to find a short interval during which there is a lull in the symptoms. At this point in the disease the child may begin to improve, but much more commonly this interval is quickly followed by an increase in the symptoms of profound nervous depression, the child passing into a state of coma, followed by death. When the amount of poison is originally very great, the patient may become comatose in a very few hours. These cases are practically hopeless. During the entire attack the thirst is extreme.

Diagnosis.—The diagnosis of cholera infantum should not be difficult, the history of the disease and the intensely acute onset resembling no other intestinal affection except Asiatic cholera. When the latter disease is epidemic, a bacteriologic examination is the only method of differential diagnosis. Occasionally it may be confounded with thermic fever (sunstroke), but the discharges of cholera infantum are continuous, and it lacks the high temperature which is always found in sunstroke.

Prognosis.—The prognosis of cholera infantum is always grave. If, while the attack lasts, the child is fed on milk, the disease is nearly always fatal. The prognosis naturally is more favorable in strong, healthy children than in those who are weakly. A long-continued previous diet of artificial foods seems to make the prognosis less favorable. The symptoms on which to base a favorable prognosis are a slight attack and rapid and steady decrease in the vomiting and diarrhea. The absence of symptoms of profound nervous depression are favorable. The physician, however, should not expect to save the lives of the majority of the infants affected with this disease.

Prophylactic Treatment.—The prophylactic treatment of acute milk infection consists in the careful attention to the cleanliness of the infant's food and the articles used in the nursing. If the child is fed from the breast, the nipples of the mother or nurse should be washed before and after nursing according to the rules laid down in the chapter on hygiene and diet. If fed

from the bottle, the greatest care should be exercised, particularly in summer, in scalding and thoroughly cleaning the nursing-bottle after each nursing. At all times, and especially during the summer months, any small digestive disturbance which may make its appearance must receive careful attention, and should a slight attack of diarrhea appear, milk must be stopped unless the child is nursing from the breast, and even then it is better to diminish the number of nursings and substitute definite quantities of beef broth or albumin-water for several hours. Very often at this time a dram or two of castor oil, with small doses of calomel repeated once or twice during the twenty-four hours, will end the trouble.

Treatment of the Attack.—The first indication in the treatment of milk infection—the one that is of the greatest importance—is to remove the source of the poison; hence all milk must be stopped, nor should any food containing it be given to the child. Sterilization or Pasteurization of milk does not render it a proper food in this disease. The child should receive no food at all for from eight to twelve hours—indeed, in some instances as long as twenty-four hours—after the beginning of the attack. During this time small quantities of about half an ounce of cold sterilized water should be given at regular intervals, and in order to aid in stimulating the patient brandy or whisky may be added to the water. In some cases we have had favorable results from moderately large doses of alcoholic stimulants, giving say a teaspoonful of good brandy freely diluted in cold sterilized water every hour or even oftener during the period of collapse. The second indication is to aid nature in freeing the system of the poison which is already in it. For this purpose washing out the stomach and intestines gives excellent results. These irrigations must be repeated frequently. The water must be sterilized and may be used plain, or, what is probably better, should be medicated by the use of calomel and bismuth, or any of the salts of the latter, particularly the subnitrate and subgallate, or a 1 per cent. solution of sodium chlorid. The results of these irrigations are twofold: they not only aid in clearing the intestines of the poisonous materials, but also, by the absorption of at least a quantity of the solution injected, assist in keeping up the amount of water which the system needs and of which it has lost such large quantities by the continuous discharge from the bowels. In order to maintain external bodily heat, the child should be placed in a hot bath, the temperature of which is to be increased from 95° F. (35° C.) to 110° F. (43.3° C.); the stimulating effect of this bath is increased by the addition of mustard. In some cases

placing the child in a hot pack at about 110° F. (43.3° C.) will cause reaction.

The stomach can best be irrigated with water containing 1 per cent. of sodium chlorid, after which from three to five grains of calomel may be similarly administered, as advised by Vaughn. The irrigation of the stomach and intestines should be repeated as long as the vomiting and purging continue. In the treatment of cholera infantum drugs must hold a second place; nevertheless, a few are useful. They may be administered by mouth or rectum. In order to somewhat control the large watery movements, good results sometimes follow the injection into the bowels of a pint of cool sterilized water containing from fifteen to thirty grains of tannic or gallic acid. This injection should immediately follow a copious enema of sterilized salt solution. When the system has suffered a great loss of water, as in fact it always does in this disease, and a considerable degree of collapse makes its appearance, subcutaneous injections of salt solution are indicated. For the relief of vomiting, and also as a cardiac stimulant, hypodermic injections of $\frac{1}{100}$ of a grain of morphin combined with $\frac{1}{800}$ of a grain of atropin may be used. Digitalis or digitalin may also be used as a more permanent cardiac stimulant. Minute doses of the arsenite of copper, carbolic acid with glycerin in drop doses, minute quantities of bichlorid of mercury, and many of the coal-tar products have been brought forward as useful remedies, and undoubtedly do have some effect, but all of these must take second place to the mechanical means of treatment by the washing out of the intestines and stomach. As an intestinal antiseptic salicylate of soda has been recommended by A. Jacobi and Emmet Holt. The subnitrate or subgallate of bismuth, in doses of from ten grains to a dram, the smaller doses to be administered by the mouth and the larger by the intestines, is certainly of some use. Although opium in the early stages of cholera infantum is worse than useless, yet occasionally, when the disease has lasted for some days, rectal injections of four or five drops of the tincture in warm starch water will soothe and diminish the irritability of the intestines. Small and frequently repeated doses of calomel ($\frac{1}{40}$ to $\frac{1}{30}$ of a grain given every fifteen minutes until two or three grains have been administered) have, in the authors' hands, given fully as good results as any other drug used in the treatment of this disease. When the surface temperature is high, —that is, above 103° F. (39.4° C.),—an ice-cap may be placed on the child's head, or the fever may be reduced by frequently sponging the body with tepid water, followed by friction. No antipyretic drugs should be given, as they do more harm than

good. When the surface temperature sinks below normal, stimulants in the form of a hot pack or hot bath should be employed, as has been before stated. Stimulating drugs, such as alcohol, aromatic spirits of ammonia, musk, camphor, or other agents of this class, may also be employed. After the vomiting has become less frequent, the child may be given small quantities of nourishment in the form of panopeptone, beef peptonoids, freshly prepared beef-juice, scraped beef, or albumin-water. Starch water, arrow-root, any food containing starch, advised by some as a preliminary diet after cholera infantum, have not met with very much success in the authors' hands. Our own preference is for albumin-water, some form of thin beef-extract, or light broths.

Not until the child has passed several days without any return of the symptoms of the disease should milk be used as an article of food; it should then be carefully modified, either at home or, better, at some good milk laboratory. Great care must be taken as to the cleanliness of the food, the bottle, and the nipple. When the child has been fed by the breast at the time of taking the disease, the same rules must be adhered to as when it is fed by the bottle.

SUBACUTE MILK INFECTION.

Synonyms.—Summer Diarrhea; Infectious Diarrhea; Entero-colitis; Summer Complaint.

Subacute milk infection is a form of gastro-intestinal catarrh originating from the action of poisons generated by the growth and multiplication of bacteria in the milk from which the child is fed. The poisons are either bacterial or chemic, are not so intense as those producing the acute form of the disease, but are more diffuse. The symptoms not being so severe as to cause alarm in the beginning of the disease, the patient is too often kept upon the same diet of infected milk, and thus continually receives a fresh supply of poisonous material. The number of deaths resulting from this disease is yearly much greater than from the acute form. It is almost entirely a disease of the summer months, and during this time its ravages are fearful. The number of its victims increases as soon as the temperature rises above 60° or 70° F. (15.6° or 21.1° C.), and decreases correspondingly with each cooler period. It is more prevalent in hot, damp weather than when the air is dry. Like the acute form, it is worse among the poorer classes of our great cities. Just in proportion as the milk given a child is pure and the patient's hygienic surroundings are good, just in so much is the danger of this disease decreased.

Causes.—Subacute milk infection, as has been before stated,

FIG. 23.—SUBACUTE MILK INFECTION.
(From patient in the Department of Obstetrics and Diseases of Infancy Polyclinic Hospital, Philadelphia.)

is caused by bacteria, the poisons generated by which have been

taken into the system in milk. The subacute form may also be but a simple continuation of a mild attack of acute milk infection for a period beyond the ordinary duration of the latter disease.

Pathology.—Microscopic examination of the stools will show that they contain epithelial cells, crystalline formations, occasionally blood, and in older children fibers of meat. In one case recorded by J. Lewis Smith, he states that he observed particles resembling three or four crypts of Lieberkühn united and probably thrown off as the result of ulceration. Owing to the continual irritation of the intestines, due to the inflammation set up by bacteria and their poisons and also very probably by the mechanical presence of the bacteria themselves, inflammation is set up, resulting in ulcerations here and there along the ileum and colon. The greatest amount of inflammatory change is generally found in the colon, and here ulcers may be formed either singly or in groups. They may be seen in any part of this division of the large intestine. The upper parts of the duodenum and jejunum are generally free from these inflammatory changes.

Symptoms.—The disease usually begins with a gradually increasing diarrhea and some vomiting, both of which are increased after taking nourishment. The vomiting, however, does not always appear, and when it does, it is in the more acute form of the disease. The symptoms may develop immediately after nursing, especially when the child is fed from the bottle, or may appear after an interval of cessation following an attack of acute milk infection. In this latter instance it almost invariably shows that the child has been returned too soon to a milk diet. As the bowel movements increase in frequency they will contain large quantities of mucus, undigested food, especially coagulated casein, and masses of fat. Each evacuation of the bowels is preceded and followed by the expulsion of gas. The color of the stools is at first yellow or brown, but soon changes to greenish or greenish yellow. Occasionally they are at first of a greenish color. Anorexia is present, and the child loses flesh and strength from failure of its nutritive powers. The tongue is coated with a whitish or grayish-white coat. The temperature is always increased during this disease, and its character is such that, except for the irregular time of the daily onset, it might be confounded with the fever of tuberculosis. The temperature is seldom above 102° or 103° F. (38.9° or 39.4° C.), and may be so slight as to escape detection. During the attack the child is irritable, whining and crying in its sleep. After each bowel movement it generally enjoys a short period of rest. A considerable amount of flatu-

lence is present, and this increases the amount of nervous disturbance. From the frequent irritating discharge from the bowels the entire buttocks and often the greater part of the posterior surfaces of the thighs are covered with an erythema. Enlargement of the lymphatics of the groin, throat, or neck is not infrequent, and although this is not a serious complication, yet occasionally the glands may suppurate and cause trouble. Otitis media is an occasional complication. Various forms of irregular skin eruptions of an eczematous or erythematous character are often seen, and boils are a common complication. Aphthous stomatitis is a very frequent and painful accompaniment.

Bronchopneumonia and meningitis of infective origin and middle-ear disease from the same cause are not infrequent complications. Death may occur from hypostatic congestion. Other diseases, such as nephritis or tuberculosis, not infrequently appear later in feeble children.

Diagnosis.—The diagnosis should be founded on the symptoms and history of the case. There are really very few diseases with which subacute milk infection can be confounded. From cholera infantum it is to be distinguished by the more gradual onset, its milder symptoms, and the absence of the characteristic large, watery stools found in the acute form of the disease; the vomiting and prostration are not so great, nor is the temperature so high as in cholera infantum. From the various forms of obstructions of the intestines it is to be diagnosticated by the fever, the gradual onset, and the absence of the extreme tenesmus, pain, and stercoraceous vomiting, none of which appears in subacute milk infection.

Prognosis.—The prognosis depends on the strength and vitality of the child, on its surroundings, and on the capabilities of those who attend its wants to give proper food and general care; the outlook for the recovery of feeble children—those who are fed on all varieties of foods and badly prepared milk and live amid unhygienic surroundings—is unfavorable. On the contrary, when the patient can be taken where good pure air can be breathed, especially the air of the seashore or mountains, and fed on properly prepared food, the prognosis is fairly good. The duration of the attack has also a considerable influence on the prognosis. The sooner the patient has the care of a physician, the better the prognosis.

Treatment.—As in all other forms of intestinal disease caused by the presence of bacteria and their ptomains, the careful regulation of the diet is the most important consideration. So long as milk, which is one of the best of all culture-media for bacteria,

is given the child, just so long will the disease continue. The removal of this article of diet is as much demanded in subacute milk infection as it is in the acute form. These children, then, should be relieved entirely from a milk diet, and placed upon freshly prepared animal broths or liquid peptonoids. These should be given at regular intervals of three or four hours, for regularity of feeding is of nearly as much importance as the items of diet upon which the child is fed. Albumin-water, boiled rice, or arrow-root may occasionally be substituted with benefit for the animal broths. All the foregoing articles should be freshly made. The child must not be placed on a milk diet until the disease is well under control, the discharges from the bowels have become normal in color and frequency, and vomiting has ceased. The patient, if living in a crowded tenement, should, if possible, be taken to the country, or at least where it can breathe pure air. Directions should be given the mother or nurse not to hold it in the arms any more than is necessary, but to let it lie on a moderately hard mattress where it can have the air from an open window, or, better, on a hard pillow in its coach in a cool place in the yard, or on the street after the sun goes down. Instruction should be given not to allow the child to have the nursing-bottle at its lips all the time while lying in the coach or on the bed, but it should be fed only at regular intervals, and between these should receive nothing in the way of nourishment. It should have at least one bath daily, and the diapers should be thoroughly washed and boiled. They should be changed frequently. It is also of great importance that the child drink plentifully of water, providing it be sterilized and given in small quantities at a time. A few drops of good whisky or brandy added to each drink is often helpful.

Irrigation of the intestines is of as much importance in the treatment of this disease as in other forms of infective diarrhea. Lavage of the stomach is indicated when the mucous membrane of this organ seems to be involved. When the patient is seen at the beginning of the attack, the greatest benefit can be derived from the giving of a laxative, such as moderate doses of calomel, with castor oil, and possibly a few drops of paregoric to prevent griping. When we see the patient later in the disease, small doses of calomel, combined with powdered ipecac and powdered rhubarb, are probably about as useful remedies as we can give. The various salts of bismuth and other intestinal antiseptics are of some use, but too much reliance must not be placed upon them. Large doses of paregoric, either alone or combined with chalk mixture, or the various diarrhea preparations should not be given at all. After the disease is thoroughly under control

and the digestion remains weak, such remedies as nux vomica, arsenic, particularly in the form of Fowler's solution, nitro-muriatic acid, and others of this class may be used with benefit. Iron may be employed if anemia is present. Cod-liver oil has been recommended, and is undoubtedly of use, but when the digestion is weak, as it generally is, it is best employed in the form of inunctions.

ILEOCOLITIS.

Ileocolitis, the so-called dysentery or dysenteric diarrhea, is an inflammation of the mucous membrane of the lower part of the large intestine (colon and rectum), accompanied usually by the formation of patches of ulceration, which in number may be single or multiple. The disease may be acute or chronic, and while usually sporadic, sometimes appears in an epidemic form.

Causes.—The same causes which in children produce other forms of intestinal inflammation are also active in the etiology of dysentery. Improper feeding with bad milk, improper hygiene, crowding in poorly ventilated, filthy tenements, and general lack of care are all fruitful factors in the causation of dysentery. The disease is more frequent among the poorer classes, but it will occur in any condition of life where children are not given the proper kinds of food. As a rule, the disease is more common in cities and in the "slums" of cities than in the healthy districts of the latter or in the country. Predisposing factors in the etiology of the disease are all lowered states of vitality, such as those produced by rickets, syphilis, tuberculosis, etc. The disease is probably always bacterial in origin, but, with the exception of the true diphtheric and so-called amebic forms, we can not identify the exact form of germ producing it. The path of infection in the majority of cases is probably through the food or drinking-water. The disease occasionally appears in epidemics, the cause of which is decidedly obscure, unless, like typhoid, it be carried by water, or air infected from a previously existing case.

The croupous or diphtheric form may result from diphtheria in any part of the air-passages, or it may appear as a primary infection of the entire colon or lower part of the ileum or cecum. A rare disease, known as amebic dysentery, has been described by Osler, Holt, Councilman, and others. It is caused by the **amœba** coli (Lösch) or amœba dysenteriæ (Councilman and Lafleur). Osler describes the ameba as follows: "It is a unicellular, protoplasmic, motile organism from ten to twenty

micromillimeters in diameter, and consists of a clear outer zone (ectosarc) and a granular inner zone (endosarc) containing a nucleus and one or more vacuoles." This disease is seldom seen in this country, but it is very frequent in the tropics. The source of infection is probably drinking-water.

Pathology.—The pathology of ileocolitis is considerably simplified if we remember that this disease is in many cases simply a continuation downward along the colon of the same inflammatory process as that producing an attack of enterocolitis; in fact, in the authors' opinion, the chronic form of the so-called catarrhal dysentery usually begins in this way. We find the mucous membrane of the colon and rectum congested to a very marked degree, or occasionally the inflammatory condition may extend upward as far as the ileum, or in bad cases the whole large intestine may be involved. The mucous membrane is intensely hyperemic, and this condition may be limited to circumscribed areas or may be general. Small hemorrhages sometimes take place into the mucosa or submucosa. The mucous membrane in the parts affected is covered with a thick, sticky mucus, which in some cases is extremely adhesive and hard to remove. The color of the mucous membrane varies from bright red to purple, and is seldom uniform in color. The solitary lymph-follicles along the colon are swollen, and each is surrounded by an area of hyperemia, and in many cases the breaking-down of these glands occurs later, producing an ulcer. These ulcers may be either single or multiple, and often extend considerably in size after they first begin, or in some instances two or more may coalesce, forming one large, irregular, ulcerative patch, which may simply be confined to the mucous membrane, or, proceeding deeper, may involve the submucosa or even perforate the entire wall of the intestine. The mesenteric glands are enlarged and softened. The liver is usually congested, although anemia of this organ may be present, as in the case recorded by Busey. Suppuration of the kidney may also occur. Examination of the brain will not infrequently show one or more thrombi in the sinuses of the dura mater. In other cases inflammation of the brain structure or, on the contrary, cerebral anemia may be found.

Croupous or diphtheric dysentery is the name given to a variety of the disease which is associated with the formation of diphtheric ulcers occurring in the same part of the intestine as do those of the catarrhal form. These patches are covered with a tenacious, grayish-white membrane which, when removed, leaves a bleeding ulcer. The membrane is composed of fibrin, necrotic

cells, and blood-corpuscles. Both the mucosa and submucosa undergo considerable infiltration and thickening. Between the patches the mucous membrane is congested and more or less roughened. The pathology of the amebic form is as follows :

The lesions are principally found in the lower portion of the ileum and colon, and consist of small elevations appearing along the mucous membrane and associated with infiltration. The ulcer first begins as a small papule, the upper part of which sloughs off, leaving a grayish-yellow ulcerating surface. Amebæ are found in the tissues in and around the ulcers, in the lymphatic spaces, and occasionally in the blood-vessels. Multiple abscesses arising from the same cause are usually found throughout the liver and occasionally in the lungs.

Symptoms.—In the so-called acute catarrhal form of ileocolitis the attack begins suddenly with diarrhea, accompanied by great tenesmus and followed by chills and a moderate rise of temperature. As the disease progresses the patient rapidly loses strength, the pulse becomes rapid and feeble, and the face presents a peculiar pinched, pale, and anxious expression. The weakness is increased after each evacuation of the bowels, the number of passages soon becoming very numerous. The stools at first contain ordinary fecal matter, but rapidly become smaller in quantity, more liquid, and mixed with mucus, blood, or pus, and in advanced cases contain shreds which are sometimes described as resembling the washings of raw meat. This symptom is generally associated with considerable ulceration. The urine is scanty and high colored, and in bad cases there may be absolute suppression. Vesical tenesmus is a common symptom. The abdomen is usually swollen and tympanitic. The tongue is covered with a brown fur along the center, its margin being red. Vomiting may occur, but is more generally seen in the earlier stages of the disease ; it is usually not severe. If the case progresses toward a fatal issue, the respirations become irregular and sighing, the eyes are partially closed, and the pupils are dilated. Not infrequently the child will die in a state of absolute collapse. Prolapse of the rectum frequently occurs, and is caused by the great state of relaxation in this part of the bowels. In the later stages of the disease convulsions are common, and the child may die during an attack. Microscopic examination of the stool shows large quantities of mucus, with epithelial cells of different types usually found in the lower bowel, blood-corpuscles and pus-corpuscles, fat, and a large number of bacteria. In the so-called diphtheric form of the disease the symptoms are about the same as before described, except that they are more intense.

The amebic form is characterized by a series of symptoms not unlike those of the catarrhal and diphtheric varieties, but are less severe than the latter. Large numbers of the amœba coli will be found in the stools during the diarrheal attack and will serve to verify the diagnosis.

Diagnosis.—The diagnosis of acute cases of the catarrhal form must be made by the character of the stools and by the general symptoms. The following are a few of the other types of intestinal catarrh from which it must be differentiated: From acute milk infection it is to be differentiated by its less acute onset, less amount of vomiting, and higher temperature. In dysentery the stools are smaller in quantity, contain blood, mucus, and pus, and have less odor. In ileocolitis there are not the general symptoms of acute poisoning which are always present in milk infection. From other forms of gastric or enteric catarrh dysentery can be diagnosticated by its smaller stools, intense tenesmus, and the amount of prostration following each evacuation. The stools of dysentery are distinctly bloody, and there are less of mucus and water than in the stools of other forms of enteric catarrh. In dysentery the stools lack the greenish or greenish-yellow color of those seen in other forms of inflammation affecting the upper parts of the intestines. Chronic catarrhal ileocolitis might possibly in some instances be confounded with mucous disease; the latter is, however, a long-continued affection, having less severe symptoms, less tenesmus, the stools containing large quantities of mucus, very little blood, and no pus. In mucous disease the evidences of general malnutrition are greater and more slowly progressive than in dysentery. The diphtheric form is seldom seen in infants, and, indeed, is very rare, even in older children. Its onset may be either very rapid or slow, but the symptoms are much more severe than those of the acute catarrhal variety. The pseudomembrane found in the stools greatly aids in the diagnosis. Amebic dysentery is a rare disease in this climate. When found, the stools will be seen to have a grayish-yellow color and contain blood and mucus (Adams). Its diagnostic points are the recurring attacks of diarrhea and the presence of amebæ in the stools.

Prognosis.—The average duration of the acute attack of catarrhal ileocolitis is from a week to ten days, and with proper treatment should end favorably. The prognosis varies, however, when the disease is epidemic, the mortality in some epidemics being very high. Even the acute variety may end fatally in from twelve to thirty-six hours. Favorable indications are bowel movements of moderate amount and decreasing frequency, small

quantities of blood being passed, with slight tenesmus and not a great deal of weakness following. A good, strong heart action, the absence of nervous depression, and no convulsions are all evidences of a light attack of the disease.

Treatment.—The treatment of ileocolitis may be divided into preventive and curative. The former may be secured by a careful oversight of the child's diet and hygiene, the same rules being followed as have been given in the treatment of other forms of intestinal disease. These rules should be carried out with especial strictness and care during the summer months, extra precautions being taken when the disease is epidemic, remembering especially that no attack of indigestion, however slight, in a child is too small a thing to warrant the attention of the physician. Many a fatal attack of dysentery could be checked in the incipient stage were intelligent medical aid called at this time. When the child has been fed on artificial foods containing milk or starch, it is best to stop these for a few hours and substitute a diet of beef-juice or broths. When breast fed, allow the child to nurse at rather more frequent intervals and to take very small quantities at each nursing; but even in this case, if the patient has symptoms of a severe attack, it is better to stop the milk entirely. In older children the diet is to be restricted to the lightest kind of proteid foods. A liberal supply of sterilized water or mineral waters, always given in small quantities and frequently, may be allowed. Bad cases with severe gastric complications may require lavage, and when the child is unable to swallow, it may be fed by a stomach-tube. Rectal alimentation is contraindicated in this disease, and foods which are principally digested in the intestines should be prescribed with great caution or prohibited entirely. As soon as the amount of blood in the stools lessens, the patient, if a young child, may have modified milk. The physician should personally supervise the composition of the food for each day, regulating the quantities of the milk elements as may best suit the feeble digestive powers of the patient. Strict attention must be paid to cleanliness and a good supply of fresh air. If possible, remove the child to the mountains or seashore, the latter frequently proving the better. In both, however, it is hard for the physician to so carefully supervise the diet of the child, for this must receive the greatest care even after the symptoms of the acute attack have ceased. Daily sponge-baths should be given all through the attack. If the patient is an infant, a very important point is the disinfection of the diapers; these should be well boiled and soaked in a solution of corrosive sub-

limate, carbolic acid, or chlorin preparations as soon as removed.

In dysentery, as in other forms of intestinal inflammation, the greatest benefit is always to be derived from local treatment by intestinal irrigations; here it is of importance that the irrigation, while it should be copious enough to thoroughly flush and cleanse the bowel, it should be allowed sufficient means of ingress and egress. It is better that the bowel should not be distended to an extent sufficient to produce pain; and it should also be remembered that the lining of the large intestine is thinned by ulceration, so that there is always at least a moderate danger of perforation when the liquid is forcibly injected or the bowel is overdistended by too much fluid. Irrigation can best be accomplished by a soft-rubber two-way catheter, or by using two ordinary soft-rubber catheters of about numbers 12 to 14 of the French scale. Through one of these the irrigating fluid is to be introduced, while the other is for the return flow. These should be well oiled and introduced with very great gentleness to a distance of four or five inches. A quart of water may be used in each irrigation in a child from two to five years old. The return flow must be watched to see that the fluid is not retained. The gravity or bag syringe is the only safe form to use for this purpose, and the reservoir should not be over three or four feet from the floor. The water used in the irrigation may be medicated with any one of the numerous intestinal antiseptics, but in many cases warm sterilized water made slightly alkaline by one dram of sodium chlorid to the pint of water will give good results. Many authors claim to have excellent results by using irrigations of iced water, or by gradually lowering the temperature of the water during irrigation. The number of irrigations must depend on the amount of diarrhea present; as this lessens, they may be given at increasing intervals. When the pain and tenesmus are increased greatly by the introduction of the tube, the rectum may be anesthetized by cocain in the strength of 2 to 4 per cent., the agent being used alone or with carbolic acid; these may be brushed over the mucous membrane or introduced in the form of a suppository with cocoa-butter. Some authors contend that the same effect is produced by a small ice-bag applied to the anus or by an ice suppository.

Out of all the large number of drugs, antiseptic and astringent, which have at various times been recommended as cures for this disease, there is no one upon which we can absolutely rely as a specific. Complex prescriptions should be avoided, and the innumerable new remedies should be tried with very great caution, as

through their use in many cases the physician does more harm than good. Of the astringent antiseptics, the best are probably bismuth and its salts, particularly the subgallate and subnitrate. Ipecacuanha has, in our hands, given moderately good results, and calomel has probably given the best results of all. The following prescription is recommended:

℞. Pulv. ipecac., ... gr. ss
Mass. hydrarg., ... gr. iij
Pulv. aromatic., ... gr. iv
Sacchar. alb., ... gr. xv.
Mix and make into ten powders.
SIG.—One every two hours.

In the beginning of the attack good results are often obtained by administering a dram of castor oil with a few drops of camphorated tincture of opium, the latter to prevent griping, or a single dose of sulphate of magnesia may prove beneficial. The mineral astringents give their best action after the disease has progressed for some little time, and it is then that the bismuth salts and a few of the intestinal antiseptics, particularly salol, give their best results. For the pain and tenesmus analgesic suppositories of the formula below are useful, one every hour or more:

Cocain hydrochlorate, ... 1 grain
Aqueous extract of ergot, ... 12 grains
Aristol, ... 5 "
Cocoa-butter, to make twelve suppositories.

Preparations of opium should be used with extreme caution in dysentery in children. When the disease has progressed for several days, the camphorated tincture may be used with safety, and may be combined in small doses with any of the beforementioned prescriptions. Naphthol, the sulphocarbolate of zinc, and bichlorid of mercury have all been used and have their advocates. Alcoholic stimulants are especially indicated when weakness is great, and hot fomentations may be applied over the abdomen. Enemata of small quantities of opium and starch water—five or six ounces of warm mucilage of starch and boric acid, with ten minims of tincture of opium, will often be of service after the disease has continued some days.

In amebic dysentery Councilman and Lafleur recommend the use of solutions of quinin, in a strength of 1 : 5000 to 1 : 1000, by intestinal irrigation. Injections are given with the patient in a knee-chest position.

The treatment of diphtheric dysentery is practically the same as in other forms.

AMYLOID DEGENERATION OF THE INTESTINES.

This form of intestinal disease is most commonly found associated with the same changes in other organs, particularly the liver, spleen, and kidneys, where it usually appears as the result of prolonged suppuration. More rarely it is associated with syphilis. The ileum is most apt to be attacked. The disease is rare in infants, but is occasionally seen in older children.

Pathology.—The changes begin in the walls of the capillaries and small arteries of the intestinal villi, but later the submucosa, and even the mucous membrane of the intestine, may be affected. The latter has the characteristic pale, semitranslucent appearance which is found in amyloid degeneration elsewhere. The same chemic tests as are used in the recognition of amyloid diseases of the liver are of service here. Amyloid degeneration of the intestines has no special symptoms.

The **treatment** is entirely symptomatic.

MUCOUS DISEASE.

Synonyms.—Chronic Gastro-intestinal Catarrh; Chronic Follicular Inflammation of the Intestinal Mucous Membrane; Intestinal Desquamative Catarrh; Chronic Croup of the Intestines, etc.

Under this name is described (Eustace Smith) a form of chronic intestinal catarrh characterized by the discharge from the bowels of shreds or tubes of membrane composed principally of mucin. The evacuations of the bowels are preceded by attacks of abdominal pain and are generally unaccompanied by fever. The disease usually occurs from the second to the tenth year, but is occasionally found in very young infants.

Causes.—The cause of the increased secretion of mucus is often obscure. It is probable that it is not primarily of bacterial origin, although it is certain that the number and variety of microorganisms usually found in the intestines are greatly increased in this disease, especially during an acute attack. It seems probable that a general lowering of the tone or disorganization of the nerve supply governing the functions of nutrition and assimilation may be a potent cause. Goodhart believes the disease to be of nervous origin, and attributes the usual combination of vague symptoms to nervous instability, and says that these children are very frequently the offspring of nervous parents, are descendants of families affected with diseases of the nervous system, such as

those in which epilepsy, hysteria, insanity, neuralgia, and sudden outbursts of temper are found, or families in which gout, rheumatism, or kidney diseases have been transmitted from one generation to another.

Pathology.—The mucous membrane of the intestine becomes thickened, the glandular follicles in both the small and the large intestine, and especially those of the sigmoid flexure and descending colon, become enlarged and ulcerated. The character of the mucus is at first clear or jelly-like and imperfectly membranous; secondly, it is semiopaque or flaky, and, lastly, yellowish-white, tough, and distinctly membranous, adhering closely to the intestinal surface.

Symptoms.—The child's appetite becomes capricious, and, in the course of a few days, fails almost entirely. There is pain or flatulence, or both, after taking food. Occasionally the child has an almost constant craving for food and will eat large quantities of it. No matter what the condition of the appetite is, the patient fails rapidly and progressively, the loss of bodily weight being constant. The skin is pale or of an unhealthy sallow color; very frequently it is harsh and scaly. The urine is dark and highly colored, of high specific gravity, and contains a large amount of urates. When no complications exist, neither albumin nor sugar can be found. Nervously, the child is erratic and generally depressed, irritable, or melancholic. Infants affected by the disease cry almost all the time, with that peculiar whining, irritable cry so commonly found in diseases of the digestive organs. They are peevish and impossible to amuse. Older children are equally cross, or are hysteric, hypochondriacal, and with bad memories or melancholia. Insomnia and night-terrors, with incontinence of urine, are almost constant symptoms. Odd, irregular forms of skin affections, particularly forms of herpes, sometimes appear. Occasionally boils and carbuncles are seen. Ulcerative stomatitis is very often present, and in older children chorea, defects of vision, muscular tremors, disorders of cutaneous sensation, and in fact all the chain of symptoms known as hysteroid, may be exhibited. The tongue is pale and anemic looking, with deep fissures in its center. A shiny, gum-like coating generally covers it. Occasionally, however, it is clear, stripped of epithelium, and glazed. Aphthous ulcers of the mouth and tonsils are common. The attack is often preceded by symptoms of general indigestion, with a sense of dull pain or uneasiness in the region of the umbilicus or over the head of the colon. These symptoms may continue or be increased during an attack. The abdomen is somewhat distended and tender.

The attack may be preceded by some chilliness, during which the child's finger-nails turn a little blue. There is seldom, if ever, any change or rise of temperature. Frequently the temperature is subnormal. Vomiting is infrequent. In one case we have seen the attack preceded by symptoms resembling catarrh in the upper air-passages. The number of bowel movements varies greatly. Occasionally the child will be constipated, even during the attack, as in a case in the practice of one of the authors. Mildly alkaline enemata will bring away enormous quantities of thin mucus. In other cases the stools are frequently preceded and accompanied by pain and flatulence. The breath is generally offensive, the odor being described by some as being sweet, heavy, aromatic, or resembling that of chloroform. The tonsils are nearly always enlarged and prone to inflammations. The disease frequently occurs in paroxysms, and between these attacks the child's condition may improve; the bowels are more regular, may, in fact, be even constipated, and the stools contain little or no mucus. During the attack the stools are soft, light brown or pale in color, and putty-like in consistence; they always contain large quantities of mucus. Small collections of worms are frequently found in them. A microscopic examination of the stools will show that they are made up of opaque, solid, white masses, molded or flattened, and small, flocculent pieces of semitransparent membrane. The pieces of membrane will, upon examination with a low-power objective, be seen to be composed of mucous and epithelial cells which have undergone fatty degeneration. Certain vasomotor symptoms, such as a circumscribed flush upon the cheeks, appear especially in the afternoon, and around the mouth there is generally a dusky pallor. Children thus affected frequently pick at the nose, showing alteration or irritation of reflex origin in the mucous membrane of the nose—a group of symptoms which has been long ascribed to the presence of worms.

Diagnosis.—From the color and shape of the pieces of membrane passed the disease may be confounded with tapeworm, but the characteristic symptoms and the large amount of mucus excreted should serve to differentiate. The diagnosis can be confirmed by the microscopic examination of the discharges. It should not be forgotten that in older children it is possible for tapeworm to be coexistent with this disease. The disease to which mucous enteritis bears the closest resemblance is general tuberculosis or pulmonary tuberculosis with intestinal complications. In tuberculosis we have the regularly recurring fever, while in mucous disease there is no rise of temperature, the

latter being often subnormal, except occasionally during the attack. It would be well, however, in all cases presenting the symptoms of mucous disease to examine the lungs.

Prognosis.—With a carefully regulated diet and good general treatment the prognosis is favorable, although the disease generally runs a very tedious course. Many cases continue for years, with occasional recurrences. The fundamental lesion is a neurosis, a lowered tone of the system which may be beyond repair.

Treatment.—The most important part of the treatment of mucous enteritis undoubtedly consists in the careful regulation of the daily life of the child and a strict supervision of its diet. It is impossible to lay down any fixed rule that will fit every case. We must study the character of the individual patient and place the child, as far as possible, amid those surroundings which are most soothing to its excitable, nervous state. It is of the greatest importance that such children be not forced in their education, nor kept at school for too long hours. They should be allowed to live in the open air as much as possible, and in a climate where the temperature is nearly even throughout the year. In the Eastern States it has been our experience that they do remarkably well at the seashore; however, we find cases that do much better in mountainous regions. Almost any condition where they can be allowed to live in the open air, with plenty of gentle outdoor exercise, particularly if these exercises are in the form of the ordinary plays and games of childhood, will do the patient good. Young infants should be placed in their coaches and allowed to remain in the open air for as much of the day as possible. At night they should sleep on a moderately firm mattress, in a well-ventilated room, and they should sleep alone. It is of importance that the child receive a daily bath; the water of this bath should be tepid or slightly cool, and its efficiency is sometimes increased by dissolving in it a lump of rock-salt as large as an apple; otherwise the child should be afterward sponged with alcohol and rubbed thoroughly with a moderately coarse towel until the skin is pink. When there is considerable emaciation and nutrition is bad, the entire body may be rubbed with either olive or cod-liver oil. The ordinary cotton-seed oil—the so-called olive oil of the market—will do equally well. The efficiency of oil inunctions is often increased by the addition of alcohol, in the proportion of about one part of alcohol to three parts of oil. Unless there is some special indication for it, it is best not to administer cod-liver oil by the mouth, as fats are but very poorly digested by these children, and there is danger of impairing what little

digestive action they have left. When fats can be assimilated, one of the best formulas to use is as follows:

Olive oil, ... 2 ounces
Glycerin, ... 1 ounce
The yolk of one egg
Some aromatic substance, as an elixir of pancreatin.

The foregoing, thoroughly shaken, makes a good emulsion, and to it may be added one-half minim of creasote to each dram of the mixture. Of this, one teaspoonful may be given three times a day after feeding.

The diet is a matter of the very greatest importance, and here we must again consider the needs of the individual case. It is almost impossible to lay down any general regulations for the feeding of these cases. As a rule, starchy or farinaceous foods should be excluded, and articles of diet rich in fat must be either prohibited or given with the utmost caution. Generally speaking a diet-list similar to that used in the treatment of subacute gastro-intestinal catarrh is of use here. Milk should be given with caution, and should always be guarded by the addition of bicarbonate of soda, lime-water, or even common table salt. Beef-juice, consommé, veal broth, or chicken soup, either plain or with the addition of a small quantity of rice or barley, are useful. In young children milk so modified as to contain a small quantity of fat and a rather high percentage of proteids answers very well. During an attack it is often necessary to exclude milk altogether. Moderate amounts of alcohol may be given with advantage, particularly in older children; in these cases one-half ounce to one ounce of any good dry wine, diluted in two or three parts of water, may be given with advantage once or twice a day at meals. In the medicinal treatment we have no remedy or combination of remedies that can be claimed as specific. Our object in the administration of drugs should be to keep the intestines as free as possible from infective bacteria and remove the adherent mucus. The agents which have had the greatest amount of success for this purpose are probably salol, the subnitrate, subgallate, or salicylate of bismuth, naphthol, and naphthalene. Beta-naphthol bismuth has also been greatly praised for this purpose. A few of the formulas recommended by Dujardin-Beaumetz, Droyxhe, and others are given below:

℞. Salol,
Bismuthi salicylat.,
Sodii bicar., ... āā gr. cl.
M. Divide into capsules No. xxx.
Sig.—One capsule before breakfast and dinner.

℞. Resorcin., ... gr. ii–vij
Syrup. aurantii, ... f℥j
Aqua citronelle, ... q.s. ad f℥iv.
SIG.—Three teaspoonfuls every three hours.

As in many cases the bowel movements are highly acid, especially when the child has been for a long time on a milk diet, the following may be used :

℞. Hydrarg. chlorid. mite, ... gr. iij
Sodii phosph.,
Sodii bicarb., ... aa ʒij.
M. Divide in chart No. xxiv.
SIG.—One powder every three hours.

℞. Creolin, ... gtt. i–ij
Syrup., ... f℥j
Aqua menthæ piperit., ... f℥ij.
M. SIG.—Teaspoonful every two or three hours.

Beta-naphthol bismuth may be given in doses of from two to five grains, according to the age of the child, and repeated three or four times a day. The action of this agent has been highly lauded by many authorities. In the authors' hands it has given moderately good results. We would not consider it a better intestinal antiseptic or superior in any way to the other bismuth salts or salol, or a combination of these two.

When constipation exists, mild saline laxatives or aperient waters are useful. This class of remedies not only relieves the constipation, but aids in clearing the intestine of a considerable amount of mucus. Probably the most satisfactory method of treatment consists in irrigation of the intestines once or twice a day.

Gastric lavage has been highly recommended by many authorities. In order to wash out the stomach, a soft Nélaton's catheter of number nine or ten size is attached by a short glass tube to a rubber tube, which in its turn is attached to a glass funnel. The catheter should be gently passed into the stomach of the child and the irrigating solution poured into the funnel from a pitcher; about two ounces may be introduced at a time. After each introduction of the fluid the funnel should be lowered and the contents of the stomach allowed to flow out.

About two liters of water, to which is added a teaspoonful of bicarbonate of soda or a few drops of a 6 per cent. solution of sodium benzoate, should be used during the irrigation. More liquid should be introduced, and allowed to flow back again until it comes out clear. It must not be forgotten that occasionally considerable shock, and even convulsions, may follow irrigation of the stomach, yet this method of treatment is cer-

tainly followed by the very best results. Massage of the abdomen is of undoubted use in these cases. Cutaneous electrization of the abdomen has been recommended by von Ziemssen and others. This treatment should be administered about half an hour before meals; large electrodes are to be used, one being placed upon the back and another upon the abdomen. General faradism has also been recommended. In cases where anemia is a prominent symptom, tonics, such as nux vomica, iron, or quinin, are indicated. Hydrochloric or nitrohydrochloric acid administered immediately after meals is of the greatest benefit in many cases. Enuresis and night-terrors can frequently be controlled by diet and by not allowing the child to eat too near its bedtime. Arsenic, belladonna, sulphonal, and many other remedies have been used to control this condition; the last remedy, given in capsules of two or three grains each, and repeated once, has frequently given excellent results.

CHRONIC CONSTIPATION.

By chronic constipation we understand a condition in which the contents of the bowels are not evacuated with what, in a given case, would be normal regularity and in less than normal amounts; the consistency of the evacuations is also increased, so that the effort of emptying the bowel is attended with considerable pain and muscular effort. We must understand by constipation that the number of evacuations is less than would be the normal in a given individual at a given age; thus, during the first year of life an infant may have from two to four, or even five, discharges without being considered to have had more than the normal number. In the second year of life the number of evacuations is generally about two or three a day, and from that time on they will diminish until the individual has one normal stool a day. Constipation may be described under two forms: the atonic and the spasmodic. The atonic form is generally due to a lack of the proper peristaltic motion of the intestines. In the spasmodic form the fecal movements are usually increased in size, and are much harder than normal; this will frequently produce an irritable condition of the rectum, so that the pain of a bowel movement is so great that the child will not willingly endeavor to have a fecal evacuation.

Causes.—The causes of constipation are varied; thus, the conformation of the large intestines in the child may in itself be a cause, as during this period of life the ascending and the transverse colon are shorter, and the descending colon is longer, than

in the adult. In the child there are a greater number of curves in the intestinal canal; the culdesac of the sigmoid flexure is deeper, this being especially noticeable just above the rectum. The small space in the interior of the child's pelvis into which many abdominal organs are crowded may tend to produce constipation. The imperfectly developed condition of the intestines themselves and their lack of general muscular tone are both factors in the production of flexions or twists, especially in the lower bowel. Food, also, is a very important causative factor, especially when this is in a state of partial fermentation. Milk itself, usually the proper food for the child, will, when in a condition unadapted to the digestive organs, produce constipation, and a continued diet of cereals is apt to give the same results. A deficient excretion of bile may also be a cause. Various malformations, tumors, etc., may act as etiologic factors. Constipation usually follows the administration of certain laxative drugs after the period of their action has ceased. In the majority of mild cases no pathologic changes are noticed. When the condition has been intense and has lasted for considerable time, there is frequently some irritation of the lower bowel, accompanied by a catarrhal condition, giving rise to symptoms that may for a time simulate diarrhea. In bad cases an actual ulceration of the bowel may result, although this is rare.

Symptoms.—The symptoms are, for a time, more or less obscure. However, there are generally present some headache, restlessness, occasionally a slight rise of temperature, distention and tenderness of the abdomen, and upon examination the transverse colon can generally be outlined by palpation and percussion. In very severe cases there may be dyspnea, and even convulsions of eclamptic type. Palpitation of the heart and vertigo are often present. If the condition continues for some time, the child loses its appetite, becomes restless and fretful, complaining of almost constant abdominal pain, generally expressed by crying and drawing up of the legs.

Treatment.—The treatment should consist in a speedy and thorough evacuation of the intestinal contents. For this purpose the child should be given a full dose of some brisk laxative, such as calomel, and the emptying of the lower bowel facilitated by an enema. This may be composed of plain soapsuds or of glycerin or salt and water; suppositories, too, fill an important place in the treatment of this condition. These may be made of plain Castile soap, of glycerin, or of gluten. Injections of plain cold water have been recommended by some. One of the most important agents in the therapeutics of this condition is abdom-

inal massage. This should be administered by some one who understands how to apply it correctly; a mother or nurse can readily be taught to do so. The movements should follow the course of the large intestines, and thence extend over the whole of the abdomen. The application may be made for a period of not over three minutes at the beginning, the length of the treatment being gradually increased from day to day. Both galvanism and faradism of the abdomen have been recommended, but both must always hold a place secondary in importance to massage. The question of food is an important one. This should be regulated according to the needs of the individual patient. When the child has been fed on a diet of cereals for a long time, a change to a diet at least partially composed of animal broths may give beneficial results; or, on the other hand, not infrequently a slight increase in the quantity of fat or sugar in the food will result favorably. In older children fresh fruits, such as oranges, grapefruit, etc., are highly beneficial; stewed fruits also, particularly stewed prunes, stewed peaches, or apricots, are of service. In nursing children the condition may sometimes be relieved by the administration of laxatives to the mother, particularly such agents as sulphate of magnesia or castor oil; also by increasing the amount of laxative foods in the mother's diet. Many drugs have been recommended for the cure of constipation, and in the treatment of the condition by this means great care must be exercised to prevent the intestines becoming so habituated to their use that evacuations can be had only by their aid. If possible, the aim of the physician should be to correct the condition as much as possible by diet and general regimen, so that the continued use of drugs shall not be necessary. Calomel, given in doses of from $\frac{1}{12}$ to $\frac{1}{6}$ of a grain several times a day, is of great use, but should not be continued very long, partly because of the danger of producing constitutional effects of mercury. Phosphate of soda is also a remedy of considerable value, especially as it is almost tasteless and may be given in milk or broth. It may be administered in doses of from two to five grains, and repeated. Compound licorice powder has also been highly recommended, and may be given either alone or combined with calomel. Its taste is not unpleasant, but in some cases it occasionally excites severe griping. The carbonate and sulphate of magnesium are both very useful agents; the former has comparatively little taste, and may be given in milk. The taste of the sulphate is rather nauseating, but it may frequently be given in hot water or in combination with tartaric acid and tincture of cardamom, in both of which its taste is considerably disguised.

The fluid extract of cascara sagrada, in doses of from one to five drops, is a remedy of considerable usefulness, but we have frequently found that unless its taste is disguised, it produces severe nausea. Some of the cascara cordials or other preparations of the drug now on the market may be found to obviate this difficulty. Senna is a favorite remedy, valuable to use for a change. The tincture of nux vomica, in doses of from one to five drops, sometimes aids in relieving the condition, and Fowler's solution and other forms of arsenic have proved of very considerable value in the authors' hands. When flatus is a prominent symptom, such agents as asafetida or turpentine are of use.

INTESTINAL COLIC.

The term intestinal colic is usually applied to attacks of severe griping pain, paroxysmal in character, occurring in the intestines, and unaccompanied by inflammation. It is to be distinguished from the colic of appendicitis, intussusception, gall-stones, strangulated hernia, and lead or arsenical poisoning.

Causes.—Intestinal colic is really a symptom and not a disease. It is most frequent in the first year of life, and is probably the most common cause of pain during this period. As seen in infants and young children it is usually due to flatulence produced by a mass of undigested food, chiefly milk. In infants up to six months of age its most frequent cause is a milk too rich in proteid or one in which the casein is in large masses or so tough that the digestive secretions can not decompose it. A milk overrich in fat, and much more rarely sugar, may cause colic. The farinaceous foods long continued in young infants very frequently produce intestinal distress. It is considerably more frequent in bottle-fed babies than in those fed from the breast, although it is seen when the mother's milk has become deteriorated by continued bad food, excitement or worry, taking cold, or disease, or when it is too rich in proteids. Colic is frequently seen when the maternal milk-supply is limited in quantity or when the colostrum milk has lasted beyond the usual period, and may continue while the mother is in bed. A very common cause is frequent and irregular feeding, whether by breast or bottle. Pregnancy or menstruation in the mother may cause her milk to give the child colic. On the part of the infant, a naturally enfeebled digestive tract or general nervous system is a predisposing cause, as is also dentition.

In older children colic is frequently caused by errors in diet, fruit-seeds, foreign bodies, intestinal parasites, and rarely plumbism. It not infrequently follows wetting the feet or exposure

to cold and damp. As has been before stated, colic is a symptom of appendicitis, gall-stones, strangulated hernia, and other forms of intestinal inflammation, and these must always be borne in mind in studying a case.

Intestinal colic is usually associated with flatulence, the latter being caused by gas produced by decomposing food or secretions distending the intestines and which can not be expelled, but there is in many cases associated with this a spasm of the muscular coats of the intestines which is chiefly reflex. This latter is the chief cause of the pain. In some cases there is no distention of the intestines, but only reflex spasm of their muscular walls; these latter cases are mostly the result of taking cold or getting the feet wet.

Symptoms and Diagnosis.—The symptoms of intestinal colic are so well known as to make a lengthy description unnecessary. When the attack is sudden, the child's features, which have been placid a moment before, become contracted, the face blanches, and in bad cases the fontanel always becomes depressed. The lower extremities are drawn upon the abdomen, the arms are flexed, and frequently the thumbs are also flexed and adducted. In male children there is contraction of the scrotum. The cry is loud and paroxysmal, and is expressive of sharp acute pain. The abdomen will be found hard, tense, and somewhat distended. The attack may be followed by expulsion of gas, and when this occurs, the symptoms quickly subside and the child falls asleep, probably to be awakened in a short time by another attack. The intervals between the paroxysms may be considerable, or the attacks follow one another in rapid succession or be almost continuous. The symptoms may be slight in degree or severe enough to cause severe prostration, the child being covered with perspiration. During the attack the pulse is somewhat accelerated, and the temperature in severe cases may be a little raised. Not infrequently the symptoms subside after taking food, particularly if it is warm. In many infants who are habitually badly fed, the colic is almost constant, and in these it is often hard to distinguish between the cry of hunger and that of colic; in both cases food is taken eagerly and is generally followed by temporary relief. The cry of colic, however, is more violent and paroxysmal than that of hunger, and as the pain quickly returns after taking food, the child will again cry more violently than before. In colic there are also the other symptoms expressive of pain. The cry of hunger is more continuous and not so shrill, and feeding is quickly followed by continuous relief, the child falling asleep. There are no symp-

toms of general pain. The cry of colic in infants several weeks old must also be distinguished from the cry of habit. The abdominal pain of appendicitis, intussusception, or hernia must be distinguished by the diagnostic symptoms of each condition (see articles on these subjects). An accompanying gastric colic is sometimes seen.

Treatment.—The treatment of an attack of simple colic consists in helping the intestines to unload themselves of the gas and decomposing material causing it, and to relieve the pain. For the first two there is nothing better than an enema of a half pint of luke-warm water, or, if this fails, Holt advises a second irrigation of cold water in which a teaspoonful of glycerin is dissolved. The enema may be made more efficacious by the addition of a few drops of spirits of turpentine or one fluidram of milk of asafetida. Dry heat may be applied externally by means of cloths or a hot sand, salt, or water-bag. The child's feet should be kept warm by a hot-water bottle or bag. There are a few drugs which, administered internally, may do some good. Frequently a full dose of castor oil will relieve in a short time. Calomel in small doses repeated will often do good, or pepsin, one grain, with bicarbonate of soda, two grains, given before each nursing will sometimes give relief. Probably the quickest effects are to be obtained from Hoffmann's anodyne or paregoric, given in doses of from five to ten drops. The use of preparations of opium, however, is not advised, as they do more harm than good.

Louis Starr and Hare recommend the following :

℞. Chloral hydrate, ... gr. xvj
Potass. bromid., ... gr. xxxij
Aq. menth. piperit., ... f℥ij.
M. Sig.—A teaspoonful in a little warm water every four hours for a child six months old.

Asafetida, peppermint, soda-mint, the bromids, and arsenic are among the remedies most commonly employed. Between the attacks the diet should be regulated, and when this is properly done, the colic usually disappears of itself. This attention to the diet must be directed toward the composition of the food. When the proteids are high in the breast milk, one may tentatively give warm or tepid water before each nursing ; while at the same time he adopts the methods Rotch has suggested, of cutting down these constituents of the mother's milk by diet and exercise. When the infant is fed artificially, the proteids should be lessened in the milk mixture given until a formula is prescribed which can be digested without pain. In the weak

baby or in one whose digestive functions are feeble the use of the hot-water bag in the crib serves to avert many an attack of nocturnal pain.

INTESTINAL OBSTRUCTION.

Under this title will be described together those forms of stricture of the intestinal canal, either of sudden or gradual onset, which are most commonly found in children. Among these we may include: (1) Strictures arising from organized plastic bands or adhesions, the result of abdominal inflammation by tumors or ulcerations; (2) from strangulations due to various forms of hernia; (3) from intussusception or invagination of the bowel; (4) volvulus, or twisting of the bowel upon itself; (5) mechanical obstructions caused by masses of feces or foreign bodies. The last has been already dwelt upon at some length in the article on Chronic Constipation. In children the most common form of obstruction is that known as intussusception or invagination of the bowel. Stricture resulting from bands of organized lymph, produced through a previous attack of peritonitis, is occasionally found. In the majority of cases the invagination is direct and consists in a slipping of one segment of the bowel within the other (like a glove-finger inverted on itself), the invaginated part being in nearly every case the portion which is furthest away from the anus.

Definitions.—In a certain number of cases the order of the invagination is reversed, the lower segment becoming invaginated into the upper. This is known as retrograde intussusception. The original form, which has been described, is known as direct intussusception. Intussusception involves three layers of bowel, each layer consisting of all the intestinal coats. The outer layer is known as the intussuscipiens, sheath, or receiving layer, while the internal is known as the entering layer, which, together with the middle or returning layer, constitutes the invaginated part or intussusceptum. The junction of the middle and inner layer is known as the apex. Intussusception may be double or even triple. In the former case five layers of intestines are involved, while in the latter seven layers have been found. While invagination of the bowel may occur in almost any portion, it is stated that one-half of all cases occur at the junction of the small and large intestines. When in this position the ileum becomes invaginated into the colon, the condition is known as ileocolic intussusception. In less than one-third of the whole number of cases invagination takes place only in the small intestine. This is described as ileal

or jejunal intussusception. In a small number of cases the invagination may occur only in the large intestine. This is known as colic intussusception. In most cases invagination begins in the right side of the abdomen, but in all the varieties except the first the position of the neck continually changes, owing to the following reason: As the entering layer, or intussusceptum, passes into the sheath, it carries with it a certain amount of mesentery, causing a considerable degree of traction, which produces a curving or bending of the intussusceptum toward the mesenteric side of the receiving portion. In the most common variety, the ileocecal, the invagination begins on the right side of the abdomen, but as the increase is particularly at the expense of the large intestine, the tumor will, by the time it has grown large enough to be felt by palpation, be found on the left side. It is quite possible that in some cases the ileocecal valve, with the apex of the intussusceptum, may protrude from the anus, and occasionally the apex may be detected by digital exploration of the rectum when actual extrusion does not take place.

Causes.—*Predisposing.*—It is a well-assured fact that intussusception occurs more frequently in infants and children than in adults, and in males oftener than in females. It has been stated ("American Text-book of Surgery") that more than 50 per cent. of patients are under ten years of age. It is without doubt the most common form of intestinal obstruction in children. Heushner states that three-fourths of all cases of obstruction of the bowel occurring in childhood are from intussusception. The probable reason for this may be that the colon during infancy is of greater length than in the adult, while the mesocolon is wider, thus making easier a displacement of the former.

Exciting Causes.—The exciting causes of intussusception in many cases are obscure. According to some authorities, a portion of the bowel may suddenly descend into a more or less paretic section below it, or the intussusceptum may be drawn into the intussuscipiens by a more active peristaltic action of the latter. Among other exciting causes may be mentioned a tumor of the bowel, general lack of tone, such as may occur from a state of poor nutrition, chronic diarrhea, or constipation.

The postmortem appearance of intussusception will show an elongated tumor, usually on the left side of the abdomen. The invagination will produce the appearance as though the intestine was abnormally short. Above the point of obstruction the intestine is usually dilated and filled with gas and feces, while below it is generally empty, or in some instances may contain a small

quantity of bloody mucus. The sheath is distended and frequently ulcerated, and there may be symptoms of general or local peritonitis. The intussusceptum is described as being commonly of a deep-red color, unless gangrene has set in, when it is black or greenish black in hue. The surrounding serous layers become in a short time so united under inflammatory action as to prevent reduction of the invagination. Perforation of the intestine from ulceration may take place, or a stricture occur as a secondary consequence of inflammatory action.

Symptoms.—The most prominent symptom of intussusception is pain. The pain is generally of sudden onset, beginning in the region of the umbilicus, and is at first paroxysmal and very severe. Occasionally it may radiate from the back forward. As the disease progresses the paroxysms of pain become merged, until finally it is constant. Each onset of pain is accompanied by a discharge from the rectum of a quantity of mucus and blood. In infants and young children the symptoms are more acute than in older children, and the pain is more paroxysmal in type. Between the attacks the child is quiet, but while the paroxysm is in progress the patient screams and assumes the characteristic position of intense abdominal pain—namely, the dorsal position with the thighs drawn up on the abdomen and the legs flexed against the thighs. Nausea and vomiting appear early as symptoms, and are frequently most exhausting. The vomited matter consists first of the contents of the stomach, but later frequently becomes stercoraceous. Rectal tenesmus of severe type is generally present. The abdomen is distended and tympanitic, and on the left side, usually in the iliac region, will be found a tumor which is often quite well marked and is associated with a corresponding flattening on the right side of the abdomen. Extreme tenderness is manifested over the seat of the tumor, although the entire abdomen is tender to the touch. This is especially the case in the later stages of the disease or when peritonitis has set in. The pulse is quickened and, as the condition progresses, has all the characters of the pulse of abdominal inflammation. The temperature is raised usually to about 101° to 103° F. (38.3° to 39.4° C.). The mind is clear; the countenance, while generally tranquil between the attacks of pain, will, if the condition continues for some time, assume the peculiar pinched expression always seen in peritoneal inflammation. The amount of tympanites is only moderate, and indeed may not be present. There is only one sign which is frequently noticed—namely, the depression in the right iliac fossa. This is sometimes known as the

sign of Dance (signe de Dance). The symptoms may subside gradually if the attack progresses to a favorable termination. When the pain ceases suddenly, it is usually a sign that gangrene has occurred in the constricted portion of the bowel; this may be followed by a discharge of the gangrenous portions and a subsequent recovery. Very frequently a sudden break in the temperature, accompanied by cessation of pain and rapid, thready pulse, points to the onset of collapse and death. Partial or entire suppression of urine may occur.

Diagnosis.—Intussusception can be differentiated from: (1) Colic; (2) enteritis or dysentery; (3) fecal impaction; (4) appendicitis. From *colic* it may be distinguished by the vomiting, particularly when this assumes the stercoraceous character. The special diagnostic point, however, is the tumor on the left side of the abdomen. The bloody mucous discharge is present in intussusception and not in colic. The general severity of the symptoms seen in intussusception will also aid in the diagnosis. From *enteritis* intussusception is to be distinguished by the presence of bloody discharge in the latter, the continuance of the fever, and the presence of a tumor. In dysentery there may be a blood-streaked diarrhea, but the violent attacks of pain and the general symptoms of peritoneal involvement are absent. *Impaction of feces* can be diagnosticated by the total absence of the general symptoms of intussusception, and by the fact that the tumor produced by the greatly distended bowel is on the right side of the abdomen. *Appendicitis* may be distinguished by the presence of the tumor in the right side at McBurney's point. About this will be grouped the maximum of intensity of the tympanites and abdominal tenderness. The general abdominal symptoms of an appendicitis which has existed for some time are generally those of suppurative peritonitis.

Prognosis.—The outlook for a fortunate termination without operation is very unfavorable. In this class of cases the best chance for recovery is when the invaginated portion of the intestine sloughs and is passed by the rectum. According to Treves, the mortality in 133 cases in which original operations were performed for invagination was 72 per cent. In cases where reduction was tried and was found to be easy, the mortality was 30 per cent.; or in difficult cases of reduction it was placed at 91 per cent. The best prognosis is in those cases which are operated upon early in the disease. In chronic intussusception the prognosis is very gloomy.

Treatment of Intussusception.—When unrelieved, the condition is so rapidly fatal in children that no delay whatever should

be permitted after the diagnosis is established, and prompt attempts made to reduce the invaginated bowel. Even a few hours' delay is unwise. An anesthetic should be given, the hips raised up on a pillow, and an injection of warm water given with a fountain syringe. The greatest gentleness must be exercised for fear of rupturing the gut, and the force of the column of water regulated by raising or lowering the bag of the syringe, each two and a half feet of elevation representing about one pound of pressure to the square inch. Injections of warm water containing a teaspoonful of salt to the pint or of warm olive oil are also beneficial in aiding the reduction of the intussusception.

Inflation of the bowel with atmospheric air administered through a long rectal tube and bellows may be used with advantage in some cases. The inflation of the bowel with hydrogen gas or carbonic acid gas has been recommended, the former by Senn, the latter by Ziernsen, Libur, and Jate.

If this is not successful, the child may be inverted and gentle manipulation of the abdomen attempted. This measure should never be used after the first twelve to twenty-four hours, as by that time, especially if the constriction of the bowel be very acute, softening of the coats will have occurred and the danger of rupturing it is very great.

If this is not successful, immediate abdominal section must be performed and the invagination reduced by direct manipulation.

All of these methods of treatment have their greatest amount of usefulness in the first thirty-six hours of the intussusception. The patient should be allowed but little food, and this should be systematically given and should consist of milk, concentrated broths, etc. No laxative or cathartic medicine should be given by the mouth. Alcoholic stimulants are indicated when the patient is in danger of collapse.

The best chances of success in reducing the intussusception by any of the above-mentioned methods are during the early stages—that is, within the first twenty-four hours. After that time the efforts of the medical attendant should be directed to sustaining the patient, with the hope that the process of sloughing and evacuation of the strangulated portion will occur. During this time the administration of opium is of great importance. The patient should be nourished more by nutritive enemata than by food given by the mouth. The patient's thirst may be relieved by small quantities of cracked ice, or, better still, by rectal injections of water. To relieve the vomiting, the stomach may be washed out by means of the stomach-tube.

Operation for Intussusception.—The abdomen is to be opened in the median line and attempts made to reduce the intussusception, provided the condition of the bowel warrants the belief that the integrity of the intestinal wall is not destroyed. If the operation be done early—within twenty-four to forty-eight hours—and the constriction be not extreme, this may be accomplished. If, however, the bowel shows evidence that its circulation has been materially interfered with and that there be any suspicion that its vitality is lost, it should be brought up and attached to the wound in the abdomen, an artificial anus thus being established. It would seem inadvisable to attempt an immediate resection of the damaged portion of the bowel, as at this time children are always in profound depression and their vitality is low. At best, children withstand the shock of abdominal operations badly. It is, therefore, best to relieve the immediate symptom in this way, leaving it to a subsequent time to complete the closure of the artificial anus.

Volvulus.

The symptoms produced by volvulus, or twisting of the bowel, will depend to a certain extent on the part of the bowel in which the twisting has occurred. Thus, in cases where the constriction is in the small intestine, vomiting will occur early and be persistent and severe. Wahl's sign, which he considers diagnostic, consists in a circumscribed area of tympanites corresponding to the location of the twisting. It is caused by the distention of the twisted loop of intestine by gas. Volvulus is most likely to occur in the lower portion of the ileum and the sigmoid flexure of the colon, and as compared with other forms of intestinal obstruction it is rare. Its causes in many cases are obscure. It has been ascribed to an accumulation of intestinal contents above the constricted portion of the bowel, or in some instances may be produced by adhesions of a loop of intestine to a portion of the omentum. This condition is so very rare in children that it is practically unknown.

HERNIA.

Inguinal hernia in children may be divided into three classes: (1) The congenital; (2) the funicular; (3) the encysted, or infantile.

1. In the congenital form a loop of intestine makes its way through the open funicular process. In cases where it passes into the scrotum it will frequently envelop the testicle.

2. In the funicular variety the hernia passes down the open canal, but does not envelop the testicle because of the closure of the funicular process above the testicle by the tunica vaginalis.

3. The infantile form is the rarest of the three varieties. In this the funicular process is closed above, but not below, and the intestine is encased in a pouch of peritoneum, forcing its way into the process and thence descends (Rotch).

Symptoms.—In male children a soft round tumor will be felt extending from the internal abdominal ring into the scrotum. By proper manipulation this tumor can be easily made to disappear as the gut passes into the abdomen through the abdominal ring. In doing so it will give the characteristic gurgling sound. The testicle may be difficult to outline, but it will be found above and behind the tumor. In female children the labium majus will be distended by the loop of intestine, which is generally quite easily reduced. Usually in both sexes the tumor consists of intestine alone, but occasionally some peritoneum may descend with it.

Diagnosis.—The condition with which hernia is most likely to be confounded is hydrocele.

Hydrocele.	Hernia.
1. Translucent by transmitted light.	1. Is opaque.
2. Always dull on percussion.	2. Always resonant.
3. When reduction is possible, the fluid passes back slowly and noiselessly.	3. The hernia passes back quickly and gives the characteristic gurgling sound.
4. No impulse on coughing.	4. An impulse can be felt when patient coughs.
5. The ring is empty.	5. The ring is filled with the neck of the tumor.

It should be remembered that these two conditions are occasionally associated.

Prognosis.—The outlook for cure in hernia is very good providing the child wears a properly fitting truss until the ring has had a chance to close. Strangulation is much rarer in children than in adults.

The **treatment** should consist in the prevention of constipation by the use of proper foods and medicines. The hernia should be reduced and a proper truss fitted.

The Radical Cure of Inguinal Hernia.—For many years past various operations have been devised for the radical cure of inguinal hernia, but failures were frequent and the risk to life was too great for their general acceptance. We now have, in the methods of Bassini and of Halsted, which are similar in principle,

the means for effecting a radical cure of this distressing and dangerous affection.

These methods consist in freely opening the inguinal canal, ligating the sac, transplanting the spermatic cord, and bringing it out at a point above the internal ring; then, by means of buried sutures, firmly uniting the tissues and thus obliterating the normal inguinal canal.

The results following these operations in many thousands of cases in the hands of hundreds of operators throughout the world have been so uniformly successful, both as regards final and permanent results, in effecting a radical cure, that we are no longer justified in refusing our little patients the benefit of this method of treatment.

While it is true that a large majority of the cases of inguinal hernia in children recover simply by the aid of a properly fitting truss in the course of one or two years, persistence in the use of this method should not be carried beyond this period of time.

It is not fair to permit a child to suffer all the discomforts of wearing a truss for many years, and during this time risk the grave dangers of strangulation, when we have it in our power, by these two safe methods of operative procedure, to effect a certain and permanent cure.

The mortality, when modern methods of antiseptic cleanliness are carried out, is almost nothing—far less, indeed, than risks of strangulation which the child runs with even a perfect truss.

Femoral Hernia.

In this form of hernia the intestine passes under Poupart's ligament and makes its way through the femoral canal, showing itself directly under the saphenous opening. In femoral hernia the tumor is always on the outer side of the spine of the pubic bone. This form of hernia is much rarer in children than is the inguinal form, and is always acquired, never congenital. The treatment consists in the wearing of a suitable truss.

DISEASES OF THE RECTUM.

PROLAPSE OF THE RECTUM.

Causes.—Prolapse of the rectum usually arises from a condition of atony following protracted diarrhea. It is not uncommon also in attacks of diarrhea following prolonged periods of constipation. Violent attacks of coughing, as in pertussis, may pro-

duce prolapse of the rectum. The condition is not uncommon in children affected with chronic intestinal catarrh, and is sometimes seen following the violent diarrhea of milk infection.

Symptoms.—The bowel can be recognized, appearing as a tumor through the anus; the mucous membrane is usually of a bluish-red color, from the interference with its circulation.

The **treatment** consists in the removal of the causes. Constipation should be prevented or relieved by the use of enemata; later the bowel movements should be kept liquid or semiliquid by the use of laxatives. The prolapse should be replaced and a return prevented by the use of rectal injections or suppositories containing some astringent, such as vinegar, alum, tannin, etc., or the child should evacuate the bowels while lying down, using pads or cloths to collect the feces.

The tone of the intestine should be restored as much as possible by the use of cold-water injections and by the continued use of astringents and tonics, such as strychnin or nux vomica. Occasionally it is necessary to keep the bowel in place by the use of a pad and T-bandage.

The best and most satisfactory method for treating surgically prolapse of the rectum is by linear cauterization of the mucous membrane of the prolapsus, extending well up the bowel, but great care must be exercised not to interfere with the sphincter muscle and not to cauterize too deeply. The actual cautery should be used. This should be tried in all cases before the more radical operation of excision be undertaken. This latter procedure should only be performed by a surgeon of wide experience, and if the peritoneum is opened, the danger to life is materially increased.

RECTAL POLYPI.

Polypoid tumors of the rectum may appear either in the pedunculated form or as simple hypertrophic growths of the rectal mucous membrane. They are not at all uncommon during the early years of life; in fact some authorities think they are more usual then than at any other period. The characteristic symptom is hemorrhage, which may occur at any time, but is increased during evacuation of the bowels, at which time there is also great pain. Rectal polypi are of various sizes and, according to Rotch, may be of the myxofibromatous or of the adenomatous variety.

Their treatment consists in removal either by section or by twisting them off.

Hemorrhoids and fistulæ in ano are not very common during childhood, and their treatment is the same as in the adult.

PROLAPSE OF THE ANUS.

Prolapse of the anus may be partial or complete. In the first variety the mucous membrane is sufficiently everted to protrude beyond the sphincter. In the second there is an invagination of the rectal wall which may, in some cases, be of considerable length.

Causes.—The most common predisposing cause of prolapse is any condition which lowers the tone of the rectal mucous membrane. It is, therefore, very commonly found during conditions of prolonged lowered vitality. The absorption of fat in the ischiorectal region is also a predisposing factor, occurring, as it does, in all diseases accompanied by great depression.

The most frequent exciting causes of anal prolapse are severe and continued straining and bearing-down efforts during attempts to evacuate the bowels. Phimosis, stricture of the urethra, and stone in the bladder are also given as exciting causes. It very often accompanies the more chronic forms of catarrh of the lower bowel, especially dysentery, for the reasons which have been previously given. Prolapse of the anus may be found at any period of childhood, but is most common during the second and third years.

Symptoms.—When the amount of prolapsed mucous membrane is slight, a small reddish or reddish-blue ring will be seen around the anal opening. This ring is, of course, composed of the mucous membrane of the rectum. Its appearance will usually occur during the act of defecation. When a large amount of the bowel is prolapsed, the tumor will be large and decidedly corrugated, the mucous membrane having a deep-red or even a purplish hue. In most cases the bowel is very easily replaced, but the prolapse will return with each attempt to move the bowels. The amount of pain will vary considerably, but in most cases it is severe enough to give the patient decided discomfort. There will be some tenesmus. In cases where the prolapse has existed for any length of time a considerable amount of catarrhal inflammation is set up, and the prolapsed portion of the gut may become ulcerated and more or less hemorrhage take place.

Treatment.—The first indication is to replace the prolapsed bowel, and this can easily be accomplished by making gentle pressure upon it with the finger, covered with oil or vaselin.

The child should lie upon its face across the lap of a nurse while this is being done. To prevent its recurrence, every effort should be made to prevent the child from straining during the act of defecation. Rectal injections of ordinary cold water will, in some cases, act well for this purpose, or injections of olive oil are sometimes of use. In some cases, where the mucous membrane is rather hard to replace, cold applications in the form of ice poultices or cloths soaked in cold water will be found helpful. Frequently the bowel will prolapse with every defecation. In these cases the child should be made to move its bowels while lying on its back, the buttocks meanwhile being pressed together by the nurse. Holt recommends that older children should be made to use an inclined seat placed at an angle of forty-five degrees, and after the bowel is empty, the patient is to lie on his back for half an hour or more. Patients suffering from prolonged diarrhea should have the parts treated by frequent sponging of iced water or by injections of small quantities of the same in which tannic acid, in the proportion of twenty grains to the ounce, has been dissolved. Suppositories of opium and cocain are often useful, but must be used with care. The addition of the extract of belladonna will sometimes add to their usefulness. In some cases relief is afforded by strips of adhesive plaster, two or three inches wide, placed tightly across the buttocks (Holt). Rectal injections of iced water containing five or ten drops of tincture of nux vomica, or $\frac{1}{100}$ of a grain of strychnin have been recommended. When the prolapse resists all other methods of treatment, it has been recommended that the protruding part be touched with Paquelin's cautery.

FISSURE OF THE ANUS.

This condition may be produced by bungling attempts at introducing the nozle of a syringe into the rectum, or by irritation caused by the presence of intestinal parasites. The most frequent cause is a slight excoriation of the parts by efforts at expelling a hardened mass of feces.

Symptoms.—When the fissure is of recent origin, the appearance is that of a small opening at the mucocutaneous orifice of the anus. When the condition has lasted for some time, the fissure may appear as an ulcer with indurated margins. The fissure may contain pus and even blood, both of which will be discharged during the process of evacuating the bowels. The amount of pain is very considerable: often so severe as to prevent the child

from making attempts to move the bowels, and from this arises constipation, which aggravates the condition.

Treatment.—The constipation should be overcome by the use of suitable remedies, and particularly by laxative enemata. The local treatment consists in touching the fissure with a solution of nitrate of silver after having washed it out with some nonirritating antiseptic solution. In very severe cases it may be necessary to stretch the sphincter.

The **prognosis** is usually good.

ISCHIORECTAL ABSCESS.

This condition arises most commonly from inflammation of the rectum. Traumatism may also be a cause. In the majority of cases the abscess is small, circumscribed, and superficial. The prognosis is generally good.

The treatment consists in the evacuation of the abscess under antiseptic precautions.

HEMORRHOIDS.

Hemorrhoids during childhood have the same characteristics as in later life. The most common cause is chronic constipation.

The treatment is the same as in hemorrhoids occurring in adults. They are rare in children under three years of age.

INCONTINENCE OF FECES.

Inability to control the bowels is not infrequently seen in children whose powers of resistance are lowered from various causes. Incontinence of feces also appears as one of the symptoms in the paraplegia of certain nervous diseases or any injury to the spinal cord.

The treatment should be directed to the cause. When the trouble is local, cure may sometimes be effected by the use of ergot given by the mouth or by rectal suppositories. Strychnin is a valuable corrective to the lack of tone.

PROCTITIS.

Three forms of proctitis, or inflammation of the rectum, are generally described—namely: the catarrhal, membranous, and ulcerative. In the catarrhal form the pathologic changes are those usually found in the same condition in other parts of the

intestinal tract. The mucous membrane is swollen, of a deep-red hue, with increased secretion of mucus. In many cases the mucous membrane bleeds easily. When the condition is of long standing, white or yellowish-white ulcers are to be found along any portion of the rectum, but their most frequent site is immediately inside the sphincter.

MEMBRANOUS PROCTITIS; DIPHTHERIC PROCTITIS.—It is probable that the great majority of these cases are due to infection by streptococci, although a certain number occur during a general infection of diphtheria. The pathologic changes are the same as those found in the condition known as membranous enteritis.

ULCERATIVE PROCTITIS.—This form of inflammation of the rectum is characterized by the presence of ulcers occurring along the mucous membrane. These ulcers may be superficial or deep, and are usually multiple. The condition is commonly caused by the progression of a catarrhal inflammation into the ulcerative type. The depth of the ulcers may vary rather considerably. They may be shallow, involving only the mucous membranes, or may extend deep down into the muscular coat. In the latter cases they very frequently become chronic and are of indefinite duration. Ulcers of the rectum may also be of tubercular or of syphilitic origin.

Causes.—Proctitis may be produced by an extension downward of an inflammation affecting the upper part of the large intestine; or by traumatism, as from careless efforts at the introduction of a nozle of a syringe. Intestinal parasites may produce it, and in female children it may be caused by an extension of a gonorrheal inflammation from the vagina or urethra or by direct infection through the anus. It occasionally follows or appears during the course of the acute infectious fevers. A very frequent cause is the use of irritating drugs, used either by injections or suppositories given with the intention of relieving constipation. Holt states that he has seen it produced in an infant a year old by the prolonged use of glycerin suppositories.

Symptoms.—In the catarrhal form the stools are increased in frequency and in the force by which the contents of the bowel are discharged. In this variety there is also usually a discharge of mucus, either in a liquid condition or in the form of a cast, sometimes mixed with traces of blood and preceding the discharge of the fecal contents of the bowel. True hemorrhage is rare. Tenesmus is nearly always present. Owing to the irritating character of the mucus, the external parts surrounding the anus become inflamed. Prolapse of the mucous membrane is not uncommon. The symptoms of the membranous form are very

much like those of the preceding variety, with the exception that the discharges from the bowel contain a larger quantity of pseudomembrane.

The most marked symptoms of ulcer of the rectum are pain and hemorrhage. The pain is usually severe, and is referred to the region of the anus or coccyx or the surrounding parts. The hemorrhage is seldom severe, although occasionally quite a large quantity of blood may be passed. It is usually clotted and will accompany every movement of the bowels. In chronic cases more or less pus may be found with each stool.

Treatment.—The indications for treatment are to keep the patient at rest, to aid the digestion as much as possible, and to relieve the local condition. When the pain is severe, suppositories or injections of starch water and opium should be used, or cocain may be brushed over the surface of the mucous membrane. Cocain may also be applied in the form of a suppository. Bland, slightly alkaline injections are of great use. They should consist of starch or lime-water or 1 per cent. saline solution. When the rectal discharges are highly acid, the enemata may be made alkaline, or alkalies may be given by the mouth. In order to decrease the quantity of the evacuation injections of saline fluid should be given, and these followed by enemata containing tannic acid in a strength of ten grains to the ounce. A 1 per cent. solution of hamamelis has also been recommended for this purpose. The same treatment as is used for the catarrhal form will apply to the membranous variety. Ulcers of the rectum are in many cases obstinate and slow in yielding to remedies. The indications for treatment are rest in bed, a bland diet largely made up of milk, and the injection, two or three times a day, of boric acid solution. Local applications of a solution of nitrate of silver of the strength of one or two grains to the ounce may be applied to the ulcer after the bowels have been well washed out. Opium should be given if the pain is excessive.

CHAPTER VI.

DISEASES OF THE PERITONEUM.

APPENDICITIS.

It has become a custom, by the common consent of authorities, to apply the name appendicitis to inflammations in and about the vermiform appendix, notwithstanding the fact that inflammation of the cecum, typhlitis, and perityphlitis until quite recently received differential description in text-books. Clinical experience demonstrates that almost invariably instances of inflammatory conditions in the right iliac fossa have a common origin in the appendix vermiformis.

Etiology and Pathology.—The causes of appendicitis may be conveniently divided into predisposing and exciting. Of the predisposing causes may specially be mentioned peculiarities of structure, both congenital and acquired. Appendicitis is more common during early than late life, in those who are habitually or periodically constipated, and in those subject to intestinal catarrh.

Among the predisposing causes may be mentioned departures from the normal shape and situation of the appendix, together with conditions of feeble nutrition. These, combined with irregularities in the development of its mesentery, may tend to produce a condition of twisting, as has been pointed out by Broca.*

Accumulations of irritating or poisonous substances within the appendix, and especially collections of feces, may be considered as a predisposing rather than an exciting cause. Indigestion plays an important rôle as a causative factor. Heredity has been mentioned as a favoring cause; thus, Roux, quoted by Dieulafoy,† says that in his experience heredity shows this in families affected by gout, urinary and biliary gravel, and diseases of this nature. He has proposed to apply the term appendicular

* "Gaz. Hebd. de Méd.," Paris, 1896, vol. XLIII, p. 1026.

† "Clinical Journal," London, 1896, vol. VIII, p. 312.

lithiasis to the type which produces this effect in the canal of the appendix in the same manner as biliary lithiasis does in the gall-bladder. While it is not possible as yet to place much significance upon this theory, still the question opens up a wide field for further observation. Traumatism and the lodgment of foreign bodies may also be considered under the head of predisposing causes. Foreign bodies, such as seeds, pieces of hair, glass, pins, etc., are probably occasional causes. Exposure to cold and wet, traumatisms, the straining of the abdominal muscles, and abuse of astringent purgatives have all been described as exciting causes.

Bacteriology.—Studies of the diseases of the vermiform appendix invariably demonstrate the presence of the bacillus coli communis alone, in pure cultures, or associated with the streptococcus pyogenes. To account for the assumption of virulence of the otherwise harmless bacteria Dieulafoy * insists that the closure of the canal is the cause of this pathologic change in the bacillus. In consideration of his theory it has been found that the canal of the appendix may be obstructed by the calculus, to which the term "calculous appendicitis" has been applied. These calculi are usually formed singly, but occasionally three or four are seen together. They are made up of a stercoral base with a mixture of calcareous sulphates and phosphates; they also combine chlorids and sulphates. They are of a brownish color and variable consistency. Section of one of them generally shows stratification. They exhibit a slow, progressive development in the canal of the appendix. The lumen of the canal may also be obstructed by reason of a local affection causing swelling of its walls. As Rendu † reports, the canal may also be obstructed by fibrinous formations. Lastly, two or more of these factors may be found associated in causing the obstruction. Laveran disagrees with Dieulafoy, ‡ and insists that the closure of the appendix is the result and not the cause of the inflammation and its sequence. However, the fact remains that from the degenerated condition of the cells of the mucosa of the appendix virulent types of malignant bacteria develop and may penetrate the peritoneal cavity, either through a perforation or, as shown by Klecki, § through the lymph-spaces of the damaged intestinal walls.

* "Clinical Journal," London, vol. VIII, p. 310.

† "Bulletin et Memoires de la Société Med. des Hôpitaux," 1896, No. 4, p. 81.

‡ "Bulletin de la Academie de Med.," Paris, 1896, vol. XXXV, p. 461.

§ "Annales de l'Institute Pasteur," vol. LIX, p. 710.

Morbid Anatomy.—Inflammation of the vermiform appendix may be found in any of its classic stages; thus, there are recognized the catarrhal, ulcerative, and the gangrenous varieties. All these really are part of one process, differences depending upon the source and virulence of inflammation. Any one of these forms may be circumscribed or diffused. In the catarrhal variety the walls of the appendix are found thickened and hyperemic. The submucosa and muscular coats are infiltrated by embryonic connective-tissue cells. The lumen of the tube is filled with the débris of inflammation, which is thus becoming narrowed, and finally, if the condition continues, the canal may become obliterated. The marked peculiarity of inflammation of the appendix is the rapid involvement of all its coats. The catarrhal stage may end in resolution or go on to obliteration of the canal and perforation of the tube. When ulceration occurs, the source is in the base of the muscular coat. The mucous and submucous tissues are for the most part destroyed. The ulcer may perforate the appendix or, if healing occurs, stricture of the tissues may ensue. Dilatation of the tube may occur beyond the point of obliteration. In the gangrenous variety, known by some as interstitial appendicitis, a rapid necrosis of all the coats of the gut takes place. In a very large class of cases there may be no foreign body contained in the lumen of the appendix; not infrequently, however, there is found a fecal concretion teeming with virulent bacteria. These, if perforation occurs, exude into the peritoneal cavity, starting up intense peritonitis. The organ may be partially or entirely necrosed—not infrequently the entire appendix is detached by sloughing. The general peritoneal cavity becomes walled off by fibrous adhesions, the result of extension of inflammation to the peritoneum. If perforation should occur before this happens, diffuse peritonitis results; otherwise the fibrinous exudate, by causing adhesions between the appendix, intestinal coils, and the abdominal walls, acts as a barrier to general infection. In most cases suppuration quickly follows the serous exudation, and a localized abscess is formed. This may break into the general peritoneal cavity or escape through the intestine, or form a fistula through the abdominal wall. Retroperitoneal abscesses occur when the perforation takes place along the line of attachment of adhesions. Hodenpyl * calls attention to the fact that inflammation of the appendix may result from tuberculous or lymphoid ulcers, although this is rarely seen.

---

* "New York Med. Jour.," December 30, 1893.

Symptoms.—Appendicitis may be divided into two varieties: the catarrhal, the phenomena of which are relatively slight, cases often escaping recognition, and perforative appendicitis, producing gravest appearances and effects.

Appendicitis in its incipient stage produces symptoms so obscure and varied in character that they are often either unrecognized or, if seen, their importance is not appreciated. The first symptom of the disease is pain. Its occurrence is generally sudden and unexpected and may be associated with a chill. The pain varies in intensity from mild discomfort to extreme agony, and is constant; in many cases it may, however, be intermittent. At the outset of the disease the seat of pain may be referred to any area of the abdomen or, as sometimes happens, to the whole abdominal region. No matter where it begins, in a short time it is localized in the right iliac fossa or over the inflamed appendix. Tenderness quickly manifests itself on the right side, with its point of maximum intensity in the region of the appendix—that is, at a point near the outer edge of the right rectus abdominis muscle. Its position may be described as being near the center of a line drawn between the umbilicus and the anterior superior spine of the right ileum. This point is frequently called McBurney's point. In the event of the appendix occupying an anomalous position, this point of tenderness will be correspondingly changed. Resistance of the walls of the right iliac fossa becomes first noticeable. When a considerable amount of tenderness is present, the right rectus muscle becomes retracted and tense, so as to resist palpation. The abdomen becomes distended and tympanitic, and a circumscribed swelling can be made out a little beneath the point of greatest tenderness. Gentle palpation will reveal a tumor of oval shape and some tenderness, the length being about two inches. Over the area of swelling the percussion-note is varied, this variation depending upon the proximity of the swollen appendix and its exudate to the abdominal wall. In the later stages of the disease fluctuation may, perhaps, be elicited in this area. To guard these tender points and give himself greater comfort, the patient lies in the dorsal position with the right leg drawn up. A rapid elevation of temperature is usual at the onset. In the beginning of the attack the fever may reach 102° to 104° F. (38.9° to 40° C.), but later falls one or two degrees. Cases mild in type may not reach more than 101° or 102° F. (38.3° to 38.9° C.) throughout its course, and normal or subnormal temperature is not seldom found in the severest cases. Continued high temperature points to suppuration, and a sudden

fall, while indicating in a certain number of cases beginning resolution, not infrequently indicates perforation. The pulse is accelerated, the rapidity depending to a considerable extent on the height of the fever—a rapid pulse with a low temperature demonstrates that perforation has occurred. Vomiting is more or less constant from the beginning of the attack, and occasionally is a source of much distress. When the attack proceeds favorably, the vomiting usually subsides the first day or two. When peritonitis occurs, the vomiting returns and is persistent. The patient is usually constipated, although diarrhea may be present; it is sometimes seen in the late stages of a prolonged attack. The appetite is lost; the tongue is furred and covered by a brownish coat; thirst is generally present and may be intense. The urine is scanty and at times may be albuminous; in the majority of cases it is high colored. In the early stages of the disease the patient may feel a frequent desire to evacuate the bladder. When the attack proceeds to suppuration, the condition is indicated by rigors, sweats, and considerable exhaustion. In many cases, however, the formation of an abscess is indicated only by the continued elevation of temperature and an increased tenderness over the affected area. The tumorous mass in the right iliac region increases in size, but on account of abdominal distention can only at times be demonstrated with the greatest difficulty. General involvement of the peritoneum may occur at this time from rupture of the walls of the abscess precipitating its contents into the peritoneal cavity, or a general peritonitis takes place almost from the first, caused by the invasion of septic bacteria before local adhesions have been established. When this happens, the symptoms are those of a severe peritonitis, ending usually in collapse, death almost invariably following. A certain proportion of cases end favorably without treatment, but in these the symptoms are mild in type, with but little pain and a slight elevation of temperature, which gradually, or sometimes suddenly, falls to normal. When the disease has continued for some time and suppuration has taken place, the countenance assumes the characteristic pinched expression seen almost invariably in grave abdominal diseases. The fever may then assume a hectic type, and the patient passes into a genuine "typhoid state." Infrequently in this class of cases the tumor in the right iliac region becomes boggy. The skin over it may be congested and slightly edematous. There may be pain in the right knee or ankle. Edema of the right leg may occur.

Diagnosis.—The recognition of appendicitis from its onset is of the utmost importance, and the symptoms most to be relied

upon are tenderness of the appendix itself, muscular tension of the right rectus muscle, and fever. Accepting the views of Richardson, sudden excruciating pain, becoming localized in the right iliac fossa, while of great diagnostic value in the recognition of appendicitis, indicates extension of inflammation to the peritoneum and perforation of the appendix rather than giving evidence of the incipiency of the disease. Vomiting and diarrhea are early symptoms, but are of value only when associated with the more important diagnostic points enumerated. Palpating the appendix determines the amount of enlargement and also the degree of tenderness which may be present. Tumefaction and change in the percussion-note are not usually recognized before the third or fourth day. Appendicitis must be differentiated from: (1) Acute intestinal obstruction; this occurs with considerable frequency in children, especially infants, and not seldom becomes a possibility to be considered in making a diagnosis: When the obstruction is due to an intussusception, bloody discharges from the bowel are generally present, and the tumor, instead of occupying the right iliac fossa, is found either in the median line or more prominently in the left side. The possibility also of detecting the invaginated bowel by rectal examination will aid materially in the diagnosis. (2) When strangulation of the bowel is due to a twist or volvulus, the pain is not localized, as a rule; constipation is also more pronounced than in appendicitis. Moreover, in this form of obstruction, as well as in intussusception, the vomiting is apt to be stercoraceous and is persistent. Besides this, where a volvulus occurs the abdomen is generally distended. (3) Obstruction of the bowel by collections of feces in the cecum may cause a low grade of inflammation; this condition can be recognized by its gradual development, the boggy feel of the tumor, which can be felt as an elongated mass lying in a vertical direction. There is absence of a localized point of tenderness and pain, and almost never symptoms of perforation. The inflammatory symptoms are less severe. (4) Acute indigestion and enterocolitis are excluded by the absence in them of tumor, of localized tenderness, the different character of the vomited matter, and the continued diarrhea with mucous stools. The differentiation is often impossible for a day or two. (5) Hip-joint disease and tubercular peritonitis are mentioned as sources of possible error in making a diagnosis of appendicitis, but these can be excluded usually by strictly considering the history of the case, the symptoms, and general physical aspects of both the above diseases. However, it is to be remembered that either or both of these conditions

may possibly coexist with appendicitis, in which case a diagnosis is of grave moment and requires much skill. (6) In girls at the age of puberty an abscess of the right ovary might be quite difficult to differentiate from appendicitis; in fact, the diagnosis could only be settled by vaginal examination. However, it is more common to find appendicitis in males than in females, and besides this the shape of the tumor, and the generally greater severity of symptoms of appendicitis, will aid in the diagnosis. It would be well, however, in cases where any doubt exists, to settle the diagnosis by vaginal examination, by which means the inflamed ovary can be clearly made out. It may often be impossible, without opening the abdomen, to arrive at a correct diagnosis.

Chronic Appendicitis.—The terms recurrent and relapsing appendicitis have been used in describing the return of symptoms after the first attack has subsided. One attack predisposes to another in the majority of cases. The inflammatory process of the primary seizure may have entirely disappeared, but with the result of leaving the appendix extremely susceptible to the slightest irritation, so that now and then the patient will suffer from a recurrence of the disease. The symptoms of these relapses may be as severe as the original onset, but as a general rule they are milder in type; however, the possibilities are always grave. On the other hand, the primary inflammation may subside into a latent or subacute form, causing a constant discomfort to the patient. In these cases there is an exacerbation of symptoms at short intervals. The term relapsing appendicitis has properly been applied to this latter case.

Treatment.—Absolute rest in bed, applications of external heat in the form of poultices of flaxseed or hops, with hot-water bags at the side to keep the poultices warm. Cold, in the form of an ice-bag kept constantly applied, is very useful. No opium whatever should be given for the relief of pain, as this and the tenderness are our only guides for the need of active surgical intervention. Opium masks this symptom, prevents peristalsis, and checks secretions from the intestines and kidneys. The bowels must be freely but gently opened as soon as possible. If the stomach is not too irritable, salines should be given in frequent doses every two hours until free purgation has been accomplished. If the vomiting is constant or the stomach unable to retain the saline, calomel in small doses, every hour, should be administered until the desired results have been obtained. If, after a number of hours, the calomel does not produce a free evacuation of the bowels, an enema of *hot*—very *hot*—soap and

water, to which some glycerin and magnesium sulphate have been added, may be administered, to unload the lower bowel and thus start the intestinal action.

The question of pulse and temperature is of comparatively little importance in determining the need for surgical interference, as both may continue high, and if no opium has been given, the local pain and tenderness diminish.

A sudden relief from pain and a low temperature but high pulse-rate indicate perforation of the appendix and a probable infection of the general peritoneal cavity.

Of course, a very large number of cases recover from the effects of the first acute attack by these simple measures of treatment, but it is absolutely impossible to take any number of days or hours as a guide for the necessity for surgical interference. The amount of infection of the appendix may be so great that gangrene and perforation may occur as early as in from fifteen to twenty hours after the first signs of pain, while, on the other hand, the progress of the disease may be less rapid in its development, and several days may elapse before these changes exist.

When the symptoms persist after free purgation, the pain, tenderness, and resistance on palpation in the right iliac fossa increase rather than diminish, no time should be lost in attempting further medical methods of treatment. The abdomen should be opened and the diseased appendix removed.

Evidence of abscess, unless it is absolutely circumscribed, demands immediate incision and drainage. It is not wise to make too prolonged a search for the appendix in the abscess cavity, for by so doing the thin wall of lymph, which is nature's method of protecting the surrounding tissues from infection, may be readily broken through and a general peritoneal infection be inflicted.

If a general peritonitis is present, operative interference is still more urgently demanded, and with fair chances of success if the intestines are not already paralyzed by the infecting process. In the latter condition of affairs death is almost certain no matter what course is pursued.

If the general peritonitis is extensive, with pockets of pus here and there among the intestines, an incision should be made in the left iliac fossa as well, and the whole abdominal cavity flushed with sterile salt solution, directing the stream of water from one side and allowing it to flow through the opening on the other. Drainage by gauze and rubber tubing is necessary, no attempt being made to close the abdominal openings by sutures.

TUBERCULOSIS OF THE PERITONEUM.

Tubercular peritonitis is of frequent occurrence in childhood, and in the majority of cases is secondary to a primary focus, which is oftenest a tubercular infection of the mesenteric glands. Munsterman, out of 2837 autopsies, and Boschke, in 226 cases of tubercular peritonitis, claim only to have discovered one and two respectively of primary tuberculosis of the peritoneum. The lymph-channels have been proved the common carriers for the transportation of the bacilli from some distant or near focus, such as a tubercular intestinal ulcer or a caseous degeneration of a mesenteric gland. The genital tract of the female occasionally offers a mode of infection, as is illustrated by the frequently quoted case of Vierrordt: A girl six and a half years old developed tubercular peritonitis while suffering from vaginal discharge in which the tubercle bacillus was found. A good recovery was made after eliminating the vaginal focus of infection. R. Abbe calls attention to the probability of milk food acting as a carrier of the bacillus, and suggests possible penetration of the intestinal follicles by the bacilli as the most reasonable method for their entrance in certain cases in which no other invading focus can be found.

Pathology.—Tuberculosis of the peritoneum may be but a part of a general miliary infection which, according to Zeigler, is evidenced merely by gray translucent tubercles of small size dotting the entire surface of the peritoneum, but without extensive inflammation. There may be some slight injection of the membrane, the latter being generally transparent, smooth, and glistening. In the form under discussion, in which the tuberculous process predominates in the peritoneum, inflammatory changes take place, leading to the formation of a liquid exudate. The peritoneum is thickened and opaque, connective tissue being quickly developed, causing this density. Adhesions of the intestines, numerous tubercles, and caseous deposits are to be found embedded in the infiltrated peritoneum. These are often concealed by the newly formed fibrous tissues. The exudate, which varies generally in quantity, may be composed entirely of serum, or, on the other hand, may contain fibrin, pus-cells, and occasionally blood-corpuscles. Perforation of the intestines or abdominal wall may take place. The process ends in either absorption of the inflammatory exudate with caseous metamorphosis of the débris, or the infective process may appear in other organs and end life.

Symptoms.—The symptoms will depend upon the character of the pathologic process existing in the peritoneum. If the disease is but a part of a general miliary tuberculosis, the attack is of sudden onset and the symptoms are those of acute general peritonitis, except when, after a short intermission of symptoms, a fresh outburst occurs. The fever, which is generally of true hectic character, may, after a time, completely subside, but following this reduction of temperature there is no improvement in the general health. Emaciation becomes marked, and from the coalescence and adhesions of the intestines emesis and obstinate constipation supervene. The infection being general, death usually results from the more acute process in the lungs. On the other hand, when the peritoneum has become infected from the navel, a mesenteric gland, or an intestinal ulcer, the picture presents a slow, wasting disease almost identical in nature with chronic peritonitis from other causes, differing, however, in the fact that the febrile symptoms, which at first are hardly perceptible, soon become prominent, manifesting themselves by slight exacerbations of the temperature in the evening. Accompanying this rise of temperature there are generally night-sweats, the abdomen is extremely prominent, and may or may not be tender. The bowels may be constipated, although, as a rule, diarrhea is present. This latter symptom is likely to occur in paroxysms. Meteorism is marked. The pulse is weak and small, and obstruction to the intra-abdominal circulation is made manifest by enlargement of the external abdominal veins. The little patient is peevish and much emaciated. The thoracic organs are, as a rule, free from infection. Death results from hemorrhage, occlusion of the intestines, strangulation, marasmus, general tuberculosis, or from exhaustion.

Diagnosis.—This is based upon the character of the temperature, the pain, the extreme emaciation, and diarrhea. Ascites, chronic peritonitis, and abdominal tumors must be differentiated. Many eminent surgeons claim that a diagnosis before abdominal section is but speculation.

Prognosis.—From a medical standpoint the prognosis is extremely unfavorable. Von Strümpell, Kürze, and Ziemssen teach that tubercular peritonitis always ends in death, and Baginski claims never to have seen a child survive an attack of this disease. From a surgical standpoint the outlook is considerably more favorable. Undoubtedly under suitable conditions, by surgical methods, the tubercular process may be arrested, as is attested by reports from such authorities as Halsted, Koenig, and others.

Treatment.—The medical treatment is the same as that of chronic peritonitis, together with the general treatment of tuberculosis. The indications for an incision and drainage of the abdominal cavity are imperative in all suitable cases, as the best results have been obtained from this method of treatment.

INTESTINAL PARASITES.

The parasites which most frequently infest the intestinal tract of infants and children are the oxyuris vermicularis, or the pin- or thread-worm, the ascaris lumbricoides, or round-worm. Two species of tapeworm are also recognized, the tænia mediocanellata, or beef tapeworm, and the tænia solium, or pork tapeworm; the trichocephalus dispar is also occasionally met with. None of these parasites are peculiar to infancy or childhood. The pin- and round-worms are, however, so frequently found during the earlier years of life that they are classed among the parasites peculiar to children. The tapeworm, also, is not infrequently found in intestines of children, but, as a rule, it does not appear in as young children as do the other intestinal parasites.

Oxyures Vermiculares are small worms of a pinkish-white color and fusiform shape, which inhabit the rectum, the large intestine throughout its entire length, and the lower part of the small intestine. The female of this parasite, which exists in greater numbers than the male, measures from about half an inch in length, the male being about one-half as large as the female. The female is to be distinguished by its more slender and tapering shape, as well as by its greater length. To the unassisted eye they somewhat resemble small pieces of white thread; hence their name. With a low-power objective the uterine ducts will, in the female, be seen to contain numerous ova, these being ovoid in shape, about 0.053 μ in length and 0.028 μ in breadth. The most common symptom denoting their presence is a constant itching around the anus. This irritation increases at night, and particularly when the child is in bed. In girls the same irritation appears at the entrance of the vagina, and the parasites themselves may be found here as well as on the buttocks near the anal opening. From the irritation caused by their presence a true vaginitis of catarrhal type may be set up.

The Mode of Infection.—The original ovum is probably carried to the mouth by toys, food, vegetables, drinking-water, or on the fingers of those previously infected, and each ovum brings forth a fully developed worm. Very soon the irritation produced by the worm causes the child to scratch about the anus, and numerous ova are thereby lodged under the finger-nails, to be taken with the food. It is a curious fact that the presence of the worm does not cause irritation unless it is in the lower part of the rectum, near the anus. Other than the intense itching there are no absolutely characteristic symptoms which would point to the presence of the pin-worm. The parasites themselves may be frequently found around the anus and about the vaginal opening of little girls. When the vagina becomes infested with them there is set up a vaginitis, accompanied by a very free discharge of mucus, which may occasionally be tinged with blood, caused by the continued scratching. From the same cause the anal region and buttocks may become excoriated, and later a genuine eczema may make its appearance. If the cause is long continued, the appetite becomes capricious, the child loses flesh, becomes nervous, has dark circles under the eyes, does not sleep well at nights, and, as in all other species of digestive irritation, is very apt to pick at the nose. Various other nervous symptoms may appear, such as, possibly, chorea and attacks of fainting. The diagnosis should be based on the discovery of the worms themselves. There are very few diseases with which they could be confounded, except chronic gastro-intestinal catarrh and mucous disease, both of which have more clearly defined symptoms. An enema given will scarcely fail to bring away enough of the parasites to make the diagnosis plain. In female children the irritation of the vagina may be confounded with specific vulvovaginitis, but the character of the discharge and the finding of the parasites will not long leave the diagnosis a doubtful question.

Treatment.—The first indication for treatment is to cleanse the bowels thoroughly of the worms and the mucus that surrounds them. This is best done by the administration of from one to three grains of calomel, in combination with from one to three grains of resin of scammony (dose for a child of eight years). Remedies such as spigelia, santonin, and others of the same class are often indicated. These should be given by the mouth, in combination with calomel or any agent, such as sulphate of magnesia, which will produce free watery movements. Once a day the rectum should be washed out with a copious enema of cool, weak soapsuds, and a soft-rubber catheter should

always be used in giving the enema instead of the ordinary syringe nozle, in order that the liquid may flow as high up in the bowel as possible. A very useful formula to be given by the mouth is the following :

Calomel,	½ to 1 grain
Bicarbonate of soda,	1 "
Santonin,	½ to 1 "
Podophyllin,	$\frac{1}{20}$ "

SIG.—To be repeated every night for two or three nights (for a child nine to twelve years of age).

When relaxation of the rectum is present, injections of common salt solution, quassia, alum, tannin, etc., may have a certain effect in relieving this condition. Dr. Charles W. Townsend, of Boston, recommends the injection of one dram of sulphate of iron to one pint of infusion of quassia for this purpose. In order to prevent the transferring of the ova by means of the finger-nails, the hands of the patient should be carefully washed in soapsuds after each movement of the bowels, and the parts around the anus should be well cleansed with soap and water and smeared with an antiseptic ointment. When eczema is present, the following ointment may be used, both for its antiseptic properties and to allay the irritation caused by the parasites :

Boric acid,	1 dram
Acetanilid,	20 grains
Oil of rose,	5 drops
Vaselin,	2 ounces.

It should be remembered that all means for the transference of the ova should be removed as far as possible. The bedclothing should be boiled and washed—in fact, all the clothing and furniture used by the patient should be carefully antisepticized.

ASCARIS LUMBRICOIDES (*Round-worms*).—The females of the round-worms measure from four to twelve inches in length, and are of a grayish or reddish-white color. They somewhat resemble earth-worms, from which, however, they can be distinguished by their color and the fact that the earth-worm has plainly marked segments which can be seen on close examination. The ascaris is occasionally found in the small intestines in large numbers. They are much given to wandering about, and may pass into the stomach, into the large intestine, or gall-bladder. It is said that in rare instances they have been found in the esophagus, in the pharynx, mouth, or even in the lungs. The female can be distinguished from the male by its greater size ; it is also more slender than the male, the tail being straight and tapering, while

that of the male is curved and blunter. The ova are produced in immensely large quantities and are passed off in the feces, in which they can without much difficulty be discovered by examination with a low-power objective. They are oval in shape, about $\frac{1}{400}$ of an inch in length, and have thick, transparent coats, within which the dark granular contents of the ovum can be seen. The ova, which are extremely resistant to destruction by external influences, are usually taken in by the mouth from toys, food, drinking-water, or the dust which adheres to the fingers. Children, in crawling or playing around a room, and thus bearing on their hands a quantity of dust which in many instances has come from the street, may thus carry the eggs of the parasite into the system. It is certain that ascarides are less frequently found among the better class of people in whom the laws of cleanliness are more strictly carried out than among the poor and those of uncleanly habits. They are much rarer now in all classes than they were a score of years ago. Constant bathing, with proper care of the finger-nails of children, and seeing that their food is well cooked, will do much to prevent infection by these parasites. The round-worm is much more frequently found in children after the third year than in infants or adults.

Symptoms.—It is certain that in many cases large quantities of these worms may exist for a long time within the intestinal tract without producing any symptoms at all. As the majority of intestinal parasites are found in children whose digestions are habitually weakened, the lining membrane of whose intestines are continually coated with mucus, in which these parasites thrive, the majority of the symptoms usually ascribed to the presence of worms are due in reality to a chronic state of gastric or intestinal catarrh. The classic symptoms which parents will usually expect us to associate with the presence of worms are: A capricious appetite, or in some cases a ravenous desire for food, unattended with any increase in bodily weight, or in some cases an absolute decline of it; irregular feverish attacks; disturbed sleep and bad dreams, accompanied by grinding of the teeth; pain in the stomach after taking food, and picking at the nose, and very frequently the passage from the bowels of large quantities of mucus, or, where the parasites are actually present, a number of these or their ova. It will be seen that none of these symptoms described is in any way characteristic: any or all of them may be found in most forms of intestinal catarrh. It can not be doubted, however, that a number of reflex nervous symptoms are, in susceptible subjects, caused by the presence of intestinal parasites, and probably every physician has met at

may possibly coexist with appendicitis, in which case a diagnosis is of grave moment and requires much skill. (6) In girls at the age of puberty an abscess of the right ovary might be quite difficult to differentiate from appendicitis; in fact, the diagnosis could only be settled by vaginal examination. However, it is more common to find appendicitis in males than in females, and besides this the shape of the tumor, and the generally greater severity of symptoms of appendicitis, will aid in the diagnosis. It would be well, however, in cases where any doubt exists, to settle the diagnosis by vaginal examination, by which means the inflamed ovary can be clearly made out. It may often be impossible, without opening the abdomen, to arrive at a correct diagnosis.

CHRONIC APPENDICITIS.—The terms recurrent and relapsing appendicitis have been used in describing the return of symptoms after the first attack has subsided. One attack predisposes to another in the majority of cases. The inflammatory process of the primary seizure may have entirely disappeared, but with the result of leaving the appendix extremely susceptible to the slightest irritation, so that now and then the patient will suffer from a recurrence of the disease. The symptoms of these relapses may be as severe as the original onset, but as a general rule they are milder in type; however, the possibilities are always grave. On the other hand, the primary inflammation may subside into a latent or subacute form, causing a constant discomfort to the patient. In these cases there is an exacerbation of symptoms at short intervals. The term relapsing appendicitis has properly been applied to this latter case.

Treatment.—Absolute rest in bed, applications of external heat in the form of poultices of flaxseed or hops, with hot-water bags at the side to keep the poultices warm. Cold, in the form of an ice-bag kept constantly applied, is very useful. No opium whatever should be given for the relief of pain, as this and the tenderness are our only guides for the need of active surgical intervention. Opium masks this symptom, prevents peristalsis, and checks secretions from the intestines and kidneys. The bowels must be freely but gently opened as soon as possible. If the stomach is not too irritable, salines should be given in frequent doses every two hours until free purgation has been accomplished. If the vomiting is constant or the stomach unable to retain the saline, calomel in small doses, every hour, should be administered until the desired results have been obtained. If, after a number of hours, the calomel does not produce a free evacuation of the bowels, an enema of *hot*—very *hot*—soap and

water, to which some glycerin and magnesium sulphate have been added, may be administered, to unload the lower bowel and thus start the intestinal action.

The question of pulse and temperature is of comparatively little importance in determining the need for surgical interference, as both may continue high, and if no opium has been given, the local pain and tenderness diminish.

A sudden relief from pain and a low temperature but high pulse-rate indicate perforation of the appendix and a probable infection of the general peritoneal cavity.

Of course, a very large number of cases recover from the effects of the first acute attack by these simple measures of treatment, but it is absolutely impossible to take any number of days or hours as a guide for the necessity for surgical interference. The amount of infection of the appendix may be so great that gangrene and perforation may occur as early as in from fifteen to twenty hours after the first signs of pain, while, on the other hand, the progress of the disease may be less rapid in its development, and several days may elapse before these changes exist.

When the symptoms persist after free purgation, the pain, tenderness, and resistance on palpation in the right iliac fossa increase rather than diminish, no time should be lost in attempting further medical methods of treatment. The abdomen should be opened and the diseased appendix removed.

Evidence of abscess, unless it is absolutely circumscribed, demands immediate incision and drainage. It is not wise to make too prolonged a search for the appendix in the abscess cavity, for by so doing the thin wall of lymph, which is nature's method of protecting the surrounding tissues from infection, may be readily broken through and a general peritoneal infection be inflicted.

If a general peritonitis is present, operative interference is still more urgently demanded, and with fair chances of success if the intestines are not already paralyzed by the infecting process. In the latter condition of affairs death is almost certain no matter what course is pursued.

If the general peritonitis is extensive, with pockets of pus here and there among the intestines, an incision should be made in the left iliac fossa as well, and the whole abdominal cavity flushed with sterile salt solution, directing the stream of water from one side and allowing it to flow through the opening on the other. Drainage by gauze and rubber tubing is necessary, no attempt being made to close the abdominal openings by sutures.

TUBERCULOSIS OF THE PERITONEUM.

Tubercular peritonitis is of frequent occurrence in childhood, and in the majority of cases is secondary to a primary focus, which is oftenest a tubercular infection of the mesenteric glands. Munsterman, out of 2837 autopsies, and Boschke, in 226 cases of tubercular peritonitis, claim only to have discovered one and two respectively of primary tuberculosis of the peritoneum. The lymph-channels have been proved the common carriers for the transportation of the bacilli from some distant or near focus, such as a tubercular intestinal ulcer or a caseous degeneration of a mesenteric gland. The genital tract of the female occasionally offers a mode of infection, as is illustrated by the frequently quoted case of Vierrordt: A girl six and a half years old developed tubercular peritonitis while suffering from vaginal discharge in which the tubercle bacillus was found. A good recovery was made after eliminating the vaginal focus of infection. R. Abbe calls attention to the probability of milk food acting as a carrier of the bacillus, and suggests possible penetration of the intestinal follicles by the bacilli as the most reasonable method for their entrance in certain cases in which no other invading focus can be found.

Pathology.—Tuberculosis of the peritoneum may be but a part of a general miliary infection which, according to Zeigler, is evidenced merely by gray translucent tubercles of small size dotting the entire surface of the peritoneum, but without extensive inflammation. There may be some slight injection of the membrane, the latter being generally transparent, smooth, and glistening. In the form under discussion, in which the tuberculous process predominates in the peritoneum, inflammatory changes take place, leading to the formation of a liquid exudate. The peritoneum is thickened and opaque, connective tissue being quickly developed, causing this density. Adhesions of the intestines, numerous tubercles, and caseous deposits are to be found embedded in the infiltrated peritoneum. These are often concealed by the newly formed fibrous tissues. The exudate, which varies generally in quantity, may be composed entirely of serum, or, on the other hand, may contain fibrin, pus-cells, and occasionally blood-corpuscles. Perforation of the intestines or abdominal wall may take place. The process ends in either absorption of the inflammatory exudate with caseous metamorphosis of the débris, or the infective process may appear in other organs and end life.

Symptoms.—The symptoms will depend upon the character of the pathologic process existing in the peritoneum. If the disease is but a part of a general miliary tuberculosis, the attack is of sudden onset and the symptoms are those of acute general peritonitis, except when, after a short intermission of symptoms, a fresh outburst occurs. The fever, which is generally of true hectic character, may, after a time, completely subside, but following this reduction of temperature there is no improvement in the general health. Emaciation becomes marked, and from the coalescence and adhesions of the intestines emesis and obstinate constipation supervene. The infection being general, death usually results from the more acute process in the lungs. On the other hand, when the peritoneum has become infected from the navel, a mesenteric gland, or an intestinal ulcer, the picture presents a slow, wasting disease almost identical in nature with chronic peritonitis from other causes, differing, however, in the fact that the febrile symptoms, which at first are hardly perceptible, soon become prominent, manifesting themselves by slight exacerbations of the temperature in the evening. Accompanying this rise of temperature there are generally night-sweats, the abdomen is extremely prominent, and may or may not be tender. The bowels may be constipated, although, as a rule, diarrhea is present. This latter symptom is likely to occur in paroxysms. Meteorism is marked. The pulse is weak and small, and obstruction to the intra-abdominal circulation is made manifest by enlargement of the external abdominal veins. The little patient is peevish and much emaciated. The thoracic organs are, as a rule, free from infection. Death results from hemorrhage, occlusion of the intestines, strangulation, marasmus, general tuberculosis, or from exhaustion.

Diagnosis.—This is based upon the character of the temperature, the pain, the extreme emaciation, and diarrhea. Ascites, chronic peritonitis, and abdominal tumors must be differentiated. Many eminent surgeons claim that a diagnosis before abdominal section is but speculation.

Prognosis.—From a medical standpoint the prognosis is extremely unfavorable. Von Strümpell, Kürze, and Ziemssen teach that tubercular peritonitis always ends in death, and Baginski claims never to have seen a child survive an attack of this disease. From a surgical standpoint the outlook is considerably more favorable. Undoubtedly under suitable conditions, by surgical methods, the tubercular process may be arrested, as is attested by reports from such authorities as Halsted, Koenig, and others.

Treatment.—The medical treatment is the same as that of chronic peritonitis, together with the general treatment of tuberculosis. The indications for an incision and drainage of the abdominal cavity are imperative in all suitable cases, as the best results have been obtained from this method of treatment.

INTESTINAL PARASITES.

The parasites which most frequently infest the intestinal tract of infants and children are the oxyuris vermicularis, or the pin- or thread-worm, the ascaris lumbricoides, or round-worm. Two species of tapeworm are also recognized, the tænia mediocanellata, or beef tapeworm, and the tænia solium, or pork tapeworm; the trichocephalus dispar is also occasionally met with. None of these parasites are peculiar to infancy or childhood. The pin- and round-worms are, however, so frequently found during the earlier years of life that they are classed among the parasites peculiar to children. The tapeworm, also, is not infrequently found in intestines of children, but, as a rule, it does not appear in as young children as do the other intestinal parasites.

Oxyures Vermiculares are small worms of a pinkish-white color and fusiform shape, which inhabit the rectum, the large intestine throughout its entire length, and the lower part of the small intestine. The female of this parasite, which exists in greater numbers than the male, measures from about half an inch in length, the male being about one-half as large as the female. The female is to be distinguished by its more slender and tapering shape, as well as by its greater length. To the unassisted eye they somewhat resemble small pieces of white thread; hence their name. With a low-power objective the uterine ducts will, in the female, be seen to contain numerous ova, these being ovoid in shape, about 0.053 μ in length and 0.028 μ in breadth. The most common symptom denoting their presence is a constant itching around the anus. This irritation increases at night, and particularly when the child is in bed. In girls the same irritation appears at the entrance of the vagina, and the parasites themselves may be found here as well as on the buttocks near the anal opening. From the irritation caused by their presence a true vaginitis of catarrhal type may be set up.

The Mode of Infection.—The original ovum is probably carried to the mouth by toys, food, vegetables, drinking-water, or on the fingers of those previously infected, and each ovum brings forth a fully developed worm. Very soon the irritation produced by the worm causes the child to scratch about the anus, and numerous ova are thereby lodged under the finger-nails, to be taken with the food. It is a curious fact that the presence of the worm does not cause irritation unless it is in the lower part of the rectum, near the anus. Other than the intense itching there are no absolutely characteristic symptoms which would point to the presence of the pin-worm. The parasites themselves may be frequently found around the anus and about the vaginal opening of little girls. When the vagina becomes infested with them there is set up a vaginitis, accompanied by a very free discharge of mucus, which may occasionally be tinged with blood, caused by the continued scratching. From the same cause the anal region and buttocks may become excoriated, and later a genuine eczema may make its appearance. If the cause is long continued, the appetite becomes capricious, the child loses flesh, becomes nervous, has dark circles under the eyes, does not sleep well at nights, and, as in all other species of digestive irritation, is very apt to pick at the nose. Various other nervous symptoms may appear, such as, possibly, chorea and attacks of fainting. The diagnosis should be based on the discovery of the worms themselves. There are very few diseases with which they could be confounded, except chronic gastro-intestinal catarrh and mucous disease, both of which have more clearly defined symptoms. An enema given will scarcely fail to bring away enough of the parasites to make the diagnosis plain. In female children the irritation of the vagina may be confounded with specific vulvovaginitis, but the character of the discharge and the finding of the parasites will not long leave the diagnosis a doubtful question.

Treatment.—The first indication for treatment is to cleanse the bowels thoroughly of the worms and the mucus that surrounds them. This is best done by the administration of from one to three grains of calomel, in combination with from one to three grains of resin of scammony (dose for a child of eight years). Remedies such as spigelia, santonin, and others of the same class are often indicated. These should be given by the mouth, in combination with calomel or any agent, such as sulphate of magnesia, which will produce free watery movements. Once a day the rectum should be washed out with a copious enema of cool, weak soapsuds, and a soft-rubber catheter should

always be used in giving the enema instead of the ordinary syringe nozle, in order that the liquid may flow as high up in the bowel as possible. A very useful formula to be given by the mouth is the following:

Calomel,	½ to 1 grain
Bicarbonate of soda,	1 "
Santonin,	½ to 1 "
Podophyllin,	$\frac{1}{10}$ "

SIG.—To be repeated every night for two or three nights (for a child nine to twelve years of age).

When relaxation of the rectum is present, injections of common salt solution, quassia, alum, tannin, etc., may have a certain effect in relieving this condition. Dr. Charles W. Townsend, of Boston, recommends the injection of one dram of sulphate of iron to one pint of infusion of quassia for this purpose. In order to prevent the transferring of the ova by means of the finger-nails, the hands of the patient should be carefully washed in soapsuds after each movement of the bowels, and the parts around the anus should be well cleansed with soap and water and smeared with an antiseptic ointment. When eczema is present, the following ointment may be used, both for its antiseptic properties and to allay the irritation caused by the parasites:

Boric acid,	1 dram
Acetanilid,	20 grains
Oil of rose,	5 drops
Vaselin,	2 ounces.

It should be remembered that all means for the transference of the ova should be removed as far as possible. The bedclothing should be boiled and washed—in fact, all the clothing and furniture used by the patient should be carefully antisepticized.

ASCARIS LUMBRICOIDES (*Round-worms*).—The females of the round-worms measure from four to twelve inches in length, and are of a grayish or reddish-white color. They somewhat resemble earth-worms, from which, however, they can be distinguished by their color and the fact that the earth-worm has plainly marked segments which can be seen on close examination. The ascaris is occasionally found in the small intestines in large numbers. They are much given to wandering about, and may pass into the stomach, into the large intestine, or gall-bladder. It is said that in rare instances they have been found in the esophagus, in the pharynx, mouth, or even in the lungs. The female can be distinguished from the male by its greater size; it is also more slender than the male, the tail being straight and tapering, while

that of the male is curved and blunter. The ova are produced in immensely large quantities and are passed off in the feces, in which they can without much difficulty be discovered by examination with a low-power objective. They are oval in shape, about $\frac{1}{400}$ of an inch in length, and have thick, transparent coats, within which the dark granular contents of the ovum can be seen. The ova, which are extremely resistant to destruction by external influences, are usually taken in by the mouth from toys, food, drinking-water, or the dust which adheres to the fingers. Children, in crawling or playing around a room, and thus bearing on their hands a quantity of dust which in many instances has come from the street, may thus carry the eggs of the parasite into the system. It is certain that ascarides are less frequently found among the better class of people in whom the laws of cleanliness are more strictly carried out than among the poor and those of uncleanly habits. They are much rarer now in all classes than they were a score of years ago. Constant bathing, with proper care of the finger-nails of children, and seeing that their food is well cooked, will do much to prevent infection by these parasites. The round-worm is much more frequently found in children after the third year than in infants or adults.

Symptoms.—It is certain that in many cases large quantities of these worms may exist for a long time within the intestinal tract without producing any symptoms at all. As the majority of intestinal parasites are found in children whose digestions are habitually weakened, the lining membrane of whose intestines are continually coated with mucus, in which these parasites thrive, the majority of the symptoms usually ascribed to the presence of worms are due in reality to a chronic state of gastric or intestinal catarrh. The classic symptoms which parents will usually expect us to associate with the presence of worms are: A capricious appetite, or in some cases a ravenous desire for food, unattended with any increase in bodily weight, or in some cases an absolute decline of it; irregular feverish attacks; disturbed sleep and bad dreams, accompanied by grinding of the teeth; pain in the stomach after taking food, and picking at the nose, and very frequently the passage from the bowels of large quantities of mucus, or, where the parasites are actually present, a number of these or their ova. It will be seen that none of these symptoms described is in any way characteristic: any or all of them may be found in most forms of intestinal catarrh. It can not be doubted, however, that a number of reflex nervous symptoms are, in susceptible subjects, caused by the presence of intestinal parasites, and probably every physician has met at

least one or more such cases, in which symptoms of severe nervous disturbance have been relieved by completely clearing these parasites from the bowels. A very interesting case has been reported by Townsend from the records of the Boston Children's Hospital, where a girl four years old, previously in good health, was attacked by convulsions and nervous tremors, which were distinctly traced to a large number of round-worms in the intestines. Her condition immediately improved as soon as the intestines were thoroughly cleared of these worms, and the symptoms returned as soon as a fresh quantity of the parasites were generated. There is also some danger of occlusion of the intestines, due to a simple mechanical obstruction caused by large masses of worms; thus, in Hillyer's case, in which a weakly child of five and a half years was attacked by severe abdominal pain, and upon being given a dose of oil vomited a round-worm. The child died on the following day, and at the autopsy the ileum was found occluded at a point fifteen inches above the ileocecal valve by "a tightly wound ball composed of eight round-worms; forty-two worms in all were found in the intestines. Below the obstruction the intestine was empty, while it was distended above." Round-worms are such wanderers that there is no telling where they may not travel and set up an irritation by their presence; thus they may penetrate the cystic or common bile-duct and cause jaundice by stopping the flow of bile. Abscess of the liver has been known to occur from their having penetrated this organ. They have also been known to penetrate the trachea, or even the lung, causing strangulation or pulmonary gangrene.

Diagnosis.—As the symptoms are so very unreliable, a positive diagnosis can only be made by microscopic examination of the feces. With a low-power objective, one which magnifies, say, about 320 to 350 diameters, the eggs will be easily recognized. Those of the round-worm are to be distinguished from the oxyuris, the former being larger and rounder, while those of the oxyuris or pin-worm are sharp, smaller, and more oval. From tapeworm the ova of the ascaris are to be distinguished by the fact that the latter are rounder; we have, too, in tenia, the expulsion of the segments.

Treatment.—The most successful treatment consists in the administration of santonin, usually combined with calomel or castor oil. Of all the drugs given to cause the death and expulsion of worms, santonin is probably the best. It must be remembered, however, that it is an extremely poisonous drug and must be administered with great caution. The toxic symptoms are gastro-

intestinal irritation, muscular tremor, and a sensation as if the patient were looking through yellow glass. If the poisoning continues, there will be dizziness, extreme dilatation of the pupils, convulsions, and finally loss of consciousness. Santonin is best combined with calomel, from one to three grains of the former being given with one-half to one grain of the latter. Townsend, in the "American Text-book of Diseases of Children," gives the exact dosage of santonin as follows: For two years of age, ¼ to ½ of a grain; at six years of age, one grain; and at twelve to fifteen years of age, two grains. In our own experience we have found this dosage to be about correct. The child should receive a dose in the morning and one at night, or in some cases three times daily. Some authorities recommend that a dose of santonin combined with calomel or oil should be given at night, to be followed in the morning by sulphate of magnesia or other saline. It should not be forgotten that as the patients who are most commonly infected with these worms are considerably below the average standing in bodily health, this condition should be attended to. Tonics should be administered, and the diet and general hygienic surroundings improved as much as possible. A diet containing a considerable amount of salted foods has been recommended by some authorities.

TENIA (*Tapeworm*).—The two species of tapeworm most commonly seen are the tænia solium, found in pork, and the beef tapeworm, or tænia mediocanellata. Another rare species known as the bothriocephalus latus is sometimes described. Two other rarer forms, known as the tænia nana and the tænia cucumerina, are so seldom seen in this country that they will not be more than mentioned. The length of the average tapeworm may be anywhere from twenty to fifty feet; they are of a white color, and receive their name from their resemblance to a piece of ribbon or tape. The tænia mediocanellata and the tænia solium are to be differentiated by the shape of the head, and also, to some extent, by the shape and size of the segments, the head of the tænia solium being rather pointed and containing four sucking discs, surrounded by a circle of hooklets. The head of the tænia mediocanellata is much flatter, has four discs, but no hooklets. Both species are composed of a small head, about the size of that of a pin or a little larger, and an immense number of segments. Each segment is sexually complete in itself, or what is known as hermaphroditic.

Diagnosis.—The diagnosis can be made by finding the segments and carefully examining them through the microscope. The species can be determined by the difference in the shape of

the head, already described. Microscopically, it will be seen that in the tænia mediocanellata the lateral branches of the uterus are finer and much more numerous than in the tænia solium.

Mode of Infection and History of Development.—The eggs of the two principal varieties of tapeworm usually find their way into the intestines of their human hosts in the following manner: They are at first most probably contained in manure or fertilizer, and thence are taken into the stomach of the animals most commonly used for food—namely, cattle and hogs. Having found their way into the stomach of the animal, the outer coverings of the egg are dissolved, and the embryo is set free. The embryo then pierces the stomach-walls, and, entering the blood current, is carried to any part of the animal's body, particularly the muscles, in which it buries itself, forming what is known as a cysticercous cyst. Usually not one but many of these cysts pass into the circulation of the animal at one time. Within the cyst the embryonic or larval tenia grows. These cysts are extremely tenacious of life, and they have frequently been known to remain alive in the tissues of an animal for four or five years. Unless the tissue in which they lie dormant is taken into the human stomach, the embryo finally dies, and the cyst becomes calcified. If, however, the meat containing a living cyst is taken into the human digestive organs, the scolex grows

FIG. 24.—TÆNIA NANA, VON SIEBOLD.—(*After Leuckart.*) × 10.

FIG. 25.—HEAD OF TÆNIA NANA, VON SIEBOLD; WITH RETRACTED ROSTELLUM.—(*After Leuckart.*) × 75.
A. An isolated hook. × 300.

FIG. 26.—EGG OF TÆNIA NANA, VON SIEBOLD.—(*After Leuckart.*) × 300.

rapidly into a mature tenia. The worm grows by the development of those segments nearest the head, these becoming mature as they progress further from the point of origin, and it is from these sexually mature segments that ova are given off. The worm makes its home usually in the upper part of the jejunum, or at least it is here that the head is firmly attached to the mucous membrane by hooklets and suckers. The body, composed of a vast number of segments, may extend for any distance along the intestine, depending on the length of the animal. Sometimes it may reach as far as the ileocecal valve. The tænia solium is usually found singly, while two or more of the tænia mediocanellata are often seen in a single intestine. It is quite possible—indeed, it occasionally happens—that

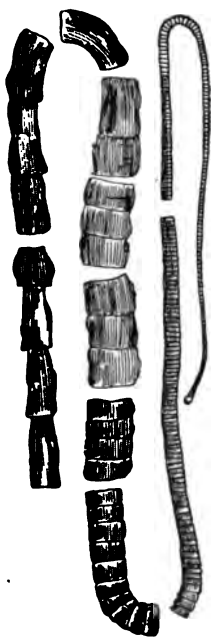


FIG. 27.—TÆNIA SAGINATA, GOEZE.—(*After Leuckart.*)

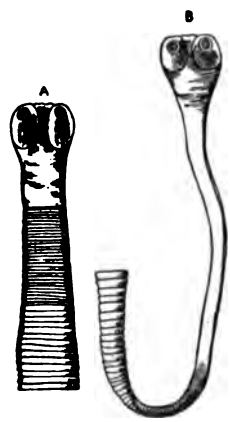


FIG. 28. — CEPHALIC END OF TÆNIA SAGINATA, GOEZE. — (*After Leuckart.*)
A in retracted and B in extended state.

the eggs of the tenia, after having been swallowed by man, pass through the coats of the stomach in the same way as in the animal, and develop a cysticercous cyst in any part of the body, especially in the subcutaneous or intermuscular connective tissue or in the eye and brain (Townsend). The cysticercus is extremely resistant to high temperatures, and it is usually by eating improperly cooked beef or pork that the infection takes place. Eating sausages made of raw pork or raw beef is a common mode of infection.

Symptoms.—The first and most common indication of the presence of a tapeworm is the finding of the segments or proglottides in the feces. Besides this, there is no regular sequence of symptoms denoting its presence any more than in other forms of intestinal parasites. Frequently there may be pain or sensations of discomfort, which are referred to the region of the umbilicus. The appetite may be great, but is accompanied by a gradual loss of bodily weight. When nervous symptoms are present, they are usually those previously referred to in the description of the other forms of intestinal parasites.

Treatment.—The treatment should be aimed at dislodging, as quickly as possible, that part of the worm known as the head, and during the administration of remedies for this purpose the feces should be examined with the greatest care by the physician himself. The success of the treatment consists in the careful administration of any one of a very few drugs. Whichever one of these is used, the method of procedure must be thorough. A great deal of the success lies in the patient carefully carrying out the rules laid down for him. The remedies most commonly used are pomegranate, or its alkaloid, pelletierin; pumpkin-seed, kousso, the root of the male-fern, turpentine, and cocoanut. Of all these, by far the most efficient is pelletierin. This may be given in the form of the tannate, which is an exceedingly efficient remedy, although expensive. The dose of this for an adult is from five to twenty grains; the dose for children, however, should be regulated according to age. The method of administration of this drug is as follows: A preparatory treatment, consisting of partial starvation, should be instituted for some hours before the teniacide is given. During this time small amounts of food which is principally digested in the stomach should be given. It has been recommended that early in the evening the child be given a bowl of beef-tea with half a slice of white bread. In a little while the patient should receive an enema and be put to bed. On the following morning a cup of beef-tea should be given, and an hour after breakfast a full dose of the anthelmintic administered, to be followed in an hour by a good active

FIG. 29.—HEAD OF TÆNIA SOLIUM. ON THE RIGHT, EGG OF TÆNIA SOLIUM.—(*Leuckart.*)

cathartic. Great care should be exercised that when the worm is expelled it is not broken off and part of it left behind in the rectum. To prevent this it may be necessary to dilate the sphincter gently by means of a rectal speculum. Next in efficiency to pomegranate and its alkaloids is the oil of male-fern, oleoresina aspidii. The dose of this drug for a child of five years is a teaspoonful. It may be given in four doses of fifteen or twenty grains each a quarter of an hour apart.

CHAPTER VII.

DISEASES OF THE LIVER.

Diseases of the liver are comparatively rare in childhood, and have received singularly little attention at the hands of systematic writers on pediatrics. Disorders of the liver are more frequently due to secondary changes, usually preventable, than those of almost any other organ. The causal processes of these operate over long periods of time, and it is a quality of infantile tissue to escape many of them. Moreover, this very rarity limits the possibility of any one observer coming in contact with many instances of organic hepatic disease, rendering them less ready to invite much literary attention. In consequence of this students are not well instructed, and instances of liver disease, when they do occur, receive less recognition and attention than their importance warrants. Functional disorders of the liver occurring in late childhood and early adolescence, however, we are told by Musser, are probably of much more frequent occurrence than we are led to believe from the text-books. Before taking up the subject of the various diseases separately, a few remarks as to the general symptomatology of affections of the liver are in order.

In a general way the symptoms of hepatic disease in childhood are the same as in the adult; thus we have the phenomena pointing to general failure of health and strength; there is a loss of appetite and other dyspeptic symptoms. The bowels are either constipated or irregularly loose. More or less jaundice usually accompanies the condition. In certain diseases of this class ascites is a prominent feature. Enlargement of the spleen and of the veins of the abdomen are also occasionally seen. From the congestion affecting the lower bowel hemorrhoids are frequently produced. In certain affections, particularly those accompanied by formation of pus in the liver, chills, fever, and sweats may occur. Various nervous disturbances, such as intense mental depression, amounting sometimes to an actual melancholia, are nearly always present. Pain is only present in certain acute diseases, such as suppurative hepatitis, in acute congestion, and in

syphilitic disease of the organ, especially where the capsule is involved. When present, it will be localized or general, rather more generally the former. It is felt on the right side of the hepatic region, and may extend to the right shoulder. As a general rule, it is dull and heavy in character, although in certain forms of hepatitis it is sharp and cutting, very closely simulating that of right-sided pleurisy or pleurodynia. However, we know that in pleurodynia we have immobility, the respirations and general movements are painful, the parts affected being tender when palpated or subjected to other methods of examination. As a general rule, also, there may be rheumatism in other parts of the body. In pleuritis the pain is distinctly increased during respiration, and is always associated with pleural friction sound. Besides this, a cough of characteristic type always attends the attack. Occasionally the symptoms of perihepatitis may so simulate those of pleurisy affecting the right side that it is almost impossible to tell them apart, but in pleurisy, sooner or later, fluid will be detected in the cavity of the pleura, while in hepatitis, of course, no such symptom will develop. The pain may also be distinctly paroxysmal, as in hepatic colic, but this affection is found so rarely in young children that it may almost be left out of the question. Pain from liver disease is apt to be constant, and is most usually increased by movement or pressure. It is liable to extend upward along the lower edge of the organ or into the epigastrium. In hepatic abscess the pain is localized, and where the abscess has resulted from traumatism, the position of pain corresponds to the point of injury. In disease accompanied by enlargement of the organ sensations of heaviness and weight are sometimes experienced on the right side.

During the early years of life the liver, in proportion to the bodily weight, is much larger than in the adult. The upper border extends to the fifth, sixth, and seventh ribs in the midclavicular, axillary, and scapulary lines respectively. The lower border can be outlined two inches below the margins of the ribs. The left lobe can be outlined with considerable ease, and extends in the median line to within an inch of the umbilicus.

In order to make a systematic examination of the organ the methods to be employed may be divided into inspection, palpation, and percussion.

Inspection.—In inspecting the abdomen and thorax of a patient suffering from hepatic disease little information can often be obtained, except in certain forms of disease. The abdomen may be somewhat distended, sometimes by flatulence and, in certain

affections, by ascites. If much enlargement of the liver is present, the lower third of the right side of the thorax and the upper part of the right side of the abdomen may be distended, and the breathing correspondingly affected on that side. Especially is the latter the case if much pain is present. In abscess and hydatid disease tumors may be outlined in the left lobe and along the lower border of the right lobe. Occasionally in abscess the skin above the affected area of the liver may assume a red color. Enlargement of the veins of the abdomen will very frequently be noticed, especially in certain diseases. The position assumed by the patient is of some value in diagnosis. When lying down, the patient will usually assume a posture on the right side, with legs drawn up; turning on the left side increases the amount of pain considerably. The breathing will often be shallow, on account of the pain felt in prolonged inspiration. The presence or absence of jaundice should be noticed.

Palpation.—The large size of the left lobe of the liver may sometimes be mistaken for a tumor, either on the surface of the liver or in the abdominal cavity. The latter may be diagnosticated by the fact that the liver will move during respiration, whereas a tumor would remain stationary. The normal outline and consistence of the liver may be changed in various forms of disease affecting it; thus, in amyloid disease a distinct induration of the surface and edge may be detected by palpation, and where fatty infiltration has taken place, these parts will be found to be smooth and soft, while in cirrhosis they are sharp and hard. A characteristic fremitus will very often be detected in hydatid disease, and a friction sound in perihepatitis. In palpating and in percussing the lower borders of the liver care should be taken to empty the transverse colon thoroughly previous to examination, as a quantity of feces contained in this part of the bowel will seriously interfere with the examination.

Percussion.—In the practice of this method of diagnosis it should be remembered that in order to outline the upper borders of the liver deep percussion must be employed, while it is best to use light percussion in defining the lower border. By means of percussion variations in the size of the liver may be detected. An irregular enlargement of the organ may point to a hepatic abscess or hydatid disease. In both of these the increase in dullness is over the convexity, if this part of the organ is affected, the area running upward and to the right; when the center of the organ is affected, the line of dullness is downward. When the left lobe is enlarged, an increase in size of this portion can be quite distinctly outlined. When fluid is present, the area of dull-

ness may be made to change by turning the patient on the left side. A tumor of the right kidney may in some cases give the sensation of being attached to the liver or may simulate enlargement of that organ, but a line of tympanites or a lighter note will be detected, and the finger will slip between the lower borders of the liver and the tumor; when doubt as to the diagnosis exists, the history of the patient and an examination of the urine will generally settle the question. Exploration of the liver can also be aided by aspiration with a hypodermic syringe. By this method specimens of pus, serum, or hydatid fluid may be drawn off and examined. Pus from an abscess in the liver will contain, principally, leucin and tyrosin, and possibly the characteristic liver-cells. When the fluid is reddish brown and mixed with blood, and especially when the amœbæ dysenteriæ are found in it, the abscess is secondary to dysentery. When serum is drawn by the hypodermic needle, we may conclude that it comes from the pleural cavity and not from the liver, as the latter does not yield serous fluid. The fluid from a hydatid is of low specific gravity, alkaline in reaction, and clear. It contains small quantities of albumin, sugar, and a considerable amount of sodium chlorid. Succinic acid may also be found. The echinococcus-membrane, hooklets, and other traces of the parasitic cause of the disease will be found on microscopic examination.

JAUNDICE OCCURRING DURING CHILDHOOD.

Jaundice may occur at any time in childhood, although the period immediately following birth is the one in which it is most frequently seen. The symptoms are usually of gradual onset, being those of a more or less severe gastric or intestinal catarrh, either of acute or subacute origin. The liver is found to be enlarged upon percussion, its outline extending below the normal line for an inch or two. There is generally, also, some tenderness in the epigastrium and right hypochondriac region. With these symptoms there is also the typical coloring of the skin, which may vary from a yellow to a brownish-yellow or almost greenish tint. The ocular conjunctiva, and even the mucous membranes of the body, may share in the general discoloration. Occasionally a slight rise of temperature accompanies these symptoms. An itching of the skin, which may be quite distressing, is frequently felt.

The **cause** is generally improper feeding, excesses in diet, or taking cold. The **diagnosis** is easy; the discoloration of the skin, the slight pyrexia, the history of indiscretions in diet or

chilling of the extremities should materially aid in distinguishing the condition. The **prognosis** is good.

Treatment.—If the attack of jaundice is severe, particularly if fever accompanies it, the patient should be kept in bed for a few days. Mild counterirritation may be made over the epigastrium by rubbing the parts with some stimulating liniment or by the application of a mustard or spice bath. Massage is of considerable use, particularly where manipulations can be made over the gall-bladder. Faradic electricity has also been advised. The diet is a matter of very great importance. No foods containing starch or sugar should be employed; the patient should be kept upon a diet of milk, diluted and made alkaline by lime-water or some alkaline mineral water. Musser advises that this milk be taken hot. Animal broths, particularly mutton broth, thin chicken broth, or beef-tea, should be the principal food employed. Foods containing fat should not be given the patient. When the digestion is weak, particularly if the patient is inclined to vomit, oyster or clam broth or koumiss may be used with advantage. As the patient improves he may be given small quantities of fresh fish or eggs and the white meat of chicken. The medicinal treatment is of considerable importance in jaundice. If seen early, very frequently a brisk laxative of calomel, combined with phosphate of soda, may be given two or three times in the twenty-four hours, this being followed by a moderate dose, say a dram, of castor oil. The combination of calomel and bismuth has also been found to be of use. The following formula has been recommended by Musser:

℞. Liquor potassii citratis, ... f℥ij
Tinct. opii camph., ... f℥j.
SIG.—One-half to one teaspoonful every two or three hours.

This formula is particularly useful when there is considerable pain. When vomiting is the prominent symptom, minute doses of hydrochlorate of cocain are of value. The treatment of the intestinal catarrh, from which this condition frequently arises, has already been dealt with at length and will not be repeated; nevertheless, there are a few special symptoms the treatment of which should require attention. Among the most prominent of these may be mentioned flatulence, with painful digestion. In the treatment of this condition the diet should be such as will be quickly assimilated, with the formation of as little gas as possible. For the medicinal treatment, extract of pancreatin in combination with an alkali, given an hour or so after meals, is the most valuable agent. Naphthalene, salol, thymol, creasote, and particularly

charcoal, may all be used with good effect in certain cases. As a combination of the two last-named agents, Musser recommends the following:

℞. Creosotum, ... gr. ¼
Carbo lig., ... gr. j
Pancreatin, ... gr. j
Bismuth. subnitras, ... gr. iij.
SIG.—Ft. chart No. i. Take after meals.

To relieve the distressing itching of the skin, which is sometimes so severe as to cause almost continual scratching, a sponging of the surface with ten drops of carbolic acid to a pint of water, or with a hot solution of borax or bicarbonate of soda, will be found very useful. If this fails, Goodhart recommends that from $\frac{1}{8\frac{1}{2}}$ to $\frac{1}{24}$ of a grain of pilocarpin should be injected hypodermically. For the cerebral symptoms, in severe cases, effort should be made to hasten as much as possible the elimination of bile, at the same time using all means possible to support the patient. For this purpose the salts of ammonia, particularly the chlorid, should be given in doses of from one to five grains, and administered in the syrup of orange or syrup of licorice, or, better, a little glycerin. Phosphate of soda is also probably one of the most valuable drugs that can be employed to hasten the elimination of bile. Caffein has also been extensively used, and pilocarpin is a valuable agent in aiding diaphoresis. When the temperature becomes subnormal, and especially if this is accompanied by considerable prostration, the patient should be fed on a nutritious, highly concentrated diet of proteid foods, and stimulation aided by moderate doses of alcohol. When hemorrhages occur, sulphuric acid and the acetate of lead are useful as astringents. Turpentine and ergot have also been employed for this purpose. When the blood is more than usually depleted by the disease, the use of oxygen has been recommended. As the patient improves he may gradually return to a more varied diet, although for a long time fatty, saccharine, or starchy foods must be used with great caution. As an aid to digestion and also to stimulate hepatic action, probably one of the most useful medicinal agents is hydrochloric or nitrohydrochloric acid. These may be given internally in doses of one or two drops, combined with some bitter tonic. Local applications of the diluted acid, applied in the form of a wet-pack over the hepatic region, have been used with very good results. Another method which has been recommended by Musser, and which was invented by Krull, is the injection of from two to four pints of water into the colon three times a day. The temperature of the water is raised with

each injection; at the first a temperature of 59° F. (15° C.) is used, and the other two enemata are made warmer until a temperature of 72° F. (22.2° C.) is reached.

CONGESTION OF THE LIVER.

Two forms of hepatic congestion are described—namely, the active and passive. The former is produced by an exaggeration of the normal congestion of the organ, which is produced by the stimulus of food. The causes of this increase in blood supply are generally overeating, the food being either too rich in quality or of a too great quantity; an abuse of stimulants may also produce the condition, but this is rare in childhood.

Symptoms.—Some pain is experienced in the region of the liver, and the organ will be found to be enlarged and tender on palpation. The increase in size will be uniform, sometimes extending for a distance of one or two inches beyond its normal boundaries. The edges and surfaces are smooth, no nodules being felt. When the gall-bladder is enlarged, it is possible to outline it in the right hypochondriac region to the left of the midclavicular line, in a line drawn from the acromion process of the right scapula to the umbilicus (Musser). The amount of jaundice is usually slight. The passive form of congestion in almost every case occurs as a secondary consequence to diseases of the heart or lungs. The liver becomes engorged with blood, this condition being due to the deficient action of the lungs or heart. Chronic malarial poisoning is also given as a cause. The increase in size is slow, constant, and uniform. According to Musser, the edge of the liver is sharper than in the active variety of congestion and is more indurated. "In the right midclavicular line the lower border may extend to the level of the umbilicus, and in the median line the left lobe may extend for three-fourths of that distance." Where there is effusion in the right pleura, the upper border can not so easily be made out. The constitutional symptoms are those of gastro-intestinal catarrh: there is loss of appetite, some nausea and vomiting, constipation, and intestinal dyspepsia. The tongue is covered with a brownish coat; the amount of jaundice is usually slight. In the passive form we have, in addition, the constitutional symptoms of organic diseases of the heart, lungs, or kidneys, affections of these organs being the most frequent cause of passive congestion of the liver. The urine is apt to be albuminous and contains considerable quantities of bile pigments. A mod-

erate amount of mental depression very frequently accompanies the disease.

The **prognosis** of the acute form of congestion is favorable. In the passive variety the prognosis will be influenced by the extent and progress of the disease causing the congestion.

Treatment.—The main objects to be accomplished in treatment are the removal of the cause of the congestion and the relief of the engorged liver by the judicious use of purgatives. The patient should be put on a low diet, and all starchy, saccharine, and fatty foods excluded. The diet should consist of animal broths, or small quantities of meat and such other foods as are digested chiefly in the stomach. Purgatives are of great use, particularly those which act directly on the liver. The two most useful of this class of agents are calomel and phosphate of soda. These may be given either alone or in combination. When combined, they are best administered in the form of a powder, capsule, or combined with the mistura glycyrrhiza. Phosphate of soda is best administered at bedtime or in the morning. It may be given in hot water, soup, or broth. Chlorid of ammonia, in doses of from three to five grains every two or three hours, has been greatly praised. Ipecacuanha has also been used with great benefit. It, however, sometimes produces such an amount of nausea and depression as to reduce its favorable action. According to some authorities, it should be administered in doses as large as five grains, twice in the twenty-four hours, to children under five years of age. A few drops of deodorized tincture of opium or a sinapism over the epigastrium are used to prevent the intense nausea. After the acute symptoms have subsided, dilute nitric acid or nitrohydrochloric acid may be given in doses of from two to ten drops three or four times a day, or local applications in the form of packs, consisting of cloths wet with diluted nitric acid, may be applied over the region of the liver. The dyspeptic symptoms should be treated by the use of bitter tonics and continued small doses of calomel, bismuth, or phosphate of soda. Small doses of silver nitrate may also be used with benefit. The passive form is best relieved by treating the condition causing it.

PHYSICAL SIGNS OF ACUTE HEPATIC ABSCESS.

The liver is irregularly enlarged, the increase in size being sometimes in an upward direction only ; generally, however, the lower border of the viscus is extended downward. Some prominence of the diseased lobe may be felt in the right hypochondriac

or epigastric region. Pain will be experienced on palpation over the affected area.

MULTIPLE HEPATIC ABSCESS.

The symptoms of this form of hepatic inflammation are frequently only those of the disease causing it. The condition, as has been before stated, arises usually from infection somewhere in the portal area; thus, injuries or disease of other abdominal viscera will produce it. Appendicitis is a very frequent cause. Usually the symptoms of multiple abscess of the liver are preceded by indications of disease in some other abdominal organ. The special symptoms of abscess are: Jaundice suddenly appears, or, where this is not very marked, the skin assumes an unhealthy, sallow hue. The liver becomes enlarged and painful, this pain being of a heavy, dragging character. Fever of an intermittent type is present, and there are daily rigors. In some cases the fever somewhat resembles typhoid. The tongue becomes dry and covered with a brownish coat. There are sordes on the teeth and lips. Nausea and vomiting are present and are accompanied by diarrhea, the stools being light colored and offensive. The urine rapidly diminishes in quantity, is highly colored, and contains much bile pigment. Albumin is present. A microscopic examination of the urine will demonstrate the presence of blood and granular and epithelial casts. The nervous system soon becomes involved, delirium of a low, muttering type appearing. Subsultus is present. Later the patient may have convulsions or may pass into a state of coma. Death may occur from exhaustion, or in some cases the kidneys become so involved that nephritis may produce a fatal termination.

Diagnosis.—In acute single hepatic abscess resulting from traumatism the diagnosis can be made by the history of injury, the irregular enlargement of the liver, and the symptoms pointing to suppuration. In doubtful cases the exploratory needle may be inserted, under strict antiseptic precaution, to aid in the diagnosis.

When multiple abscesses exist, the symptoms of hepatic abscess following evidences of disease in some other abdominal viscus should lead us to suspect the presence of this form of hepatic inflammation.

Prognosis.—When the abscess is single and can be opened externally, a favorable termination of the case is possible. The prognosis of multiple abscess is very grave.

Treatment.—The treatment should be by surgical methods.

According to the best authorities, where the number of abscesses does not exceed three, free incision should be made. When the abscess is situated along the margin of the ribs or is in the epigastric region, the operation is simple. When situated in the convexity of the right lobe, Musser advises that it should be opened through the pleural cavity, and in this case excision of the ribs is necessary. The abscess cavity should be drained and irrigated, and a drainage-tube inserted.

SYPHILITIC INFLAMMATION OF THE LIVER.

The liver may undergo changes due to the effect of general syphilitic infection. Two forms are generally seen. In one the inflammation is chiefly confined to the capsule of the organ, and in the second the connective tissue of Glisson's capsule is the seat of the organic change. The liver may be large and painful, or, where shrinking of the connective tissue occurs, the organ may diminish in size.

Symptoms.—Other manifestations of syphilis, such as coryza, cutaneous eruptions, inflammation of the mucous membranes, the peculiar cranial formation, and, in fact, any of the sequence of symptoms of specific disease, will be present. There may be some fever, the temperature rising to 100° or 101° F. (37.7° or 38.3° C.), accompanied by a corresponding rise in the pulse-rate. There may be pain on respiration. Marked tenderness will be found on palpation and percussion over the liver. A moderate amount of jaundice is generally seen. When contraction is occurring, the list of symptoms will embrace in addition those of portal obstruction.

Diagnosis.—This will be made from the direct association of the changes in the liver with other symptoms of syphilis.

The **treatment** is that of general syphilis.

SUPPURATIVE INFLAMMATION OF THE LIVER.

Synonym.—SUPPURATIVE HEPATITIS.

The suppuration may arise from one or more abscesses. The most frequent cause is a blow or fall whereby the liver is injured. When arising from this source, the abscess is usually single. Multiple hepatic abscesses most commonly arise from infection or suppuration in the portal system.

Symptoms.—These may differ widely in the two forms. In the traumatic form there is a very considerable amount of pain

in the hepatic region, accompanied by symptoms of perihepatitis. The parts about the seat of injury are swollen and discolored, and general evidences of traumatism will frequently be seen. The symptoms pointing to suppuration may follow almost immediately after those due to direct injuries, or in some cases they will appear several days after the entire subsidence of all external evidences of the injury. The symptoms of the formation of an abscess are pain over the liver, this being a prominent symptom and generally a severe one; irregular enlargement of the viscus; fever, either of a remittent or intermittent type. The rise of temperature is preceded or followed by rigors and exhaustive sweats, the patient rapidly loses flesh, the appetite fails, nausea and vomiting are present, and in many cases diarrhea soon makes its appearance. Respiration becomes difficult and painful, both inspiration and expiration being affected. The pain is generally greatest in the sixth or seventh right interspace in front, or in the seventh or eighth interspace behind, where the seat of the inflammation is on the convex surface of the liver.

INTERSTITIAL HEPATITIS.

Synonyms.—CIRRHOSIS OF THE LIVER; HOBNAIL-LIVER; GIN-DRINKER'S LIVER; SCLEROSIS OF THE LIVER.

Interstitial hepatitis is an inflammation of the true connective tissue of the liver, this being followed by contraction and hardening of the organ and an atrophy of its secreting cells. The principal characteristics of the condition are gastro-intestinal catarrh, slight jaundice, ascites, and gradual loss of bodily weight and general health. Interstitial hepatitis exists in infancy and childhood in two forms, the atrophic and the hypertrophic. The former is the more common, the latter being extremely rare.

Causes.—The most common causes are syphilis or alcoholism, the latter in childhood being most frequently produced by the too constant administration of alcohol for any purpose during the early period of life. Chronic heart disease, infectious fevers, tuberculosis, and rachitis may all be etiologic factors. Ptomainic and other poisons arising from imperfect digestion may produce the condition. Atrophic cirrhosis is the most common form in childhood, the hypertrophic form being rarely seen except congenitally. Interstitial hepatitis is said to occur more frequently in males than in females, and although it may appear at any period of childhood, the largest number of cases occur from the ninth to the nineteenth year.

Symptoms.—In the beginning the symptoms are very apt to be confounded with those of ordinary hepatic congestion arising from disturbances of the digestive tract. There are nausea and vomiting or attempts to vomit, these occurring particularly in the morning. The vomited matter consists largely of mucus. The bowels are irregular, being sometimes constipated, while at others attacks of diarrhea may occur. The stools contain considerable mucus. Hemorrhages may take place from the nose, mouth, esophagus, stomach, or intestines, and purpuric spots are occasionally seen in different parts of the body. Dilatation of the subcutaneous abdominal veins very frequently occurs. The face is pale or of a sallow hue, and numerous stigmata, composed of groups of minute veins, are seen upon it. There is a slight amount of jaundice. This may be constant, although the attacks are very apt to recur. A moderate amount of ascites is almost invariably seen, and not infrequently this may be one of the prominent symptoms of the disease. From obstruction to the portal system there is dilatation of the veins, large and small, particularly the superficial veins of the thorax or abdomen. Not infrequently a well-defined arch is seen extending across the chest, marking the attachment of the diaphragm. The superficial abdominal veins are also in many cases fairly outlined. Enlargement of the spleen frequently occurs. The temperature in the early stages is moderately elevated, a rise of two or three degrees being usual—101° to 102° F. (38.3° to 38.9° C.). This is most commonly observed in the evening. As the disease progresses, however, a subnormal temperature is the most common. The urine is of high specific gravity and contains large quantities of uric acid and urates. If nephritis develops, which it very frequently does during the course of the disease, the urine will become albuminous and will be found, on microscopic examination, to contain granular and hyaline casts. Traces of sugar will sometimes be seen. During the first stage the liver enlarges, but later steadily diminishes in size, this decrease being particularly noticeable in the left lobe. While dropsy usually seen in this disease is abdominal, yet in a certain number of cases swelling of the lower extremities may take place. In the late stages of the disease the mind becomes clouded, largely from retention of the various products of excretion, the patient becoming first dull, and later passing into coma or active delirium. Convulsions may occur.

Pathology.—In the *first stage* there is hyperemia of the connective tissue of the liver, followed by the development of the connective-tissue elements, causing an increase in size and density

of the organ. From this hypertrophy of the connective tissue pressure is made upon the true hepatic cells, causing them to undergo fatty degeneration. In the *second stage* the imperfectly developed connective tissue contracts, causing the organ to decrease in size, and producing induration. Its surfaces become nodulated, thus giving the liver the appearance which is usually characterized by the term "hobnail." Obstruction to the portal and hepatic circulations soon occurs.

The **diagnosis** is to be based upon the physical signs, the symptoms of portal obstruction, and the characteristic appearance of the face. The diseases with which cirrhosis is most likely to be confounded are, first, atrophy of the liver; but cirrhosis most commonly follows obstructive diseases of the heart or lungs. In atrophy no nodulation of the organ occurs, and the history of alcoholism or syphilis is generally wanting. Second, cirrhosis must be differentiated from tubercular peritonitis; in this disease the abdominal tenderness is general; there is rapidly developing ascites, absence of jaundice, and, in the majority of cases, the symptoms of gastro-intestinal dyspepsia are absent. On percussion the liver will be found to be normal. There are also, as a general rule, evidences of tuberculosis in other organs of the body. Cancer of the peritoneum may have some symptoms resembling those of perihepatitis, but this disease occurs very rarely in childhood. The liver will be found normal upon examination, and there will be other symptoms characteristic of cancerous disease.

The **prognosis** is very unfavorable.

Treatment.—The indications for treatment are, first, to remove the causes; second, to prevent, so far as possible, the increase of connective-tissue growth, and to relieve the engorgement of the hepatic and portal circulation. Third, if the case is too far advanced for cure, we must then endeavor to relieve the symptoms as they arise. In order to meet the first indication the causes of irritation must be removed. The patient should be allowed no alcohol in any form; all highly seasoned, fatty, or saccharine foods must be given up, and even articles of food containing starch must be used with great caution. The diet should consist principally of the lighter meats, such as the white meat of chicken or turkey, although other animal diet may be employed in moderation. To better insure its digestion it is well to have the meat finely chopped, and made into the form of a meat ball, without fat, and carefully browned. As a continuous animal diet may tend to cause scorbutus, doses of lemon-juice or diluted citric acid must be administered occasionally to counter-

act this tendency. Eggs may also be employed as an article of diet.

Probably the best food for these cases is milk,—either the best dairy milk, skimmed, or buttermilk may be used,—or in some cases where the patient tires of this article of food, which is generally the case in a short time, it may be administered in the form of various desserts, such as junket, blanc mange, or light puddings. The tendency to constipation must be corrected by the administration of alkaline aperient waters, such as Hunyadi, Saratoga, or Carlsbad. Vegetables such as spinach, lettuce, or those containing little or no starch may be allowed, but potatoes, rice, and other vegetables containing much starch should be used sparingly, if at all. The question of dress is of some importance. The patient should wear flannel next to the skin the year round, and should dress warmly enough to avoid chilling. An outdoor life in the open air is best for these cases. The medicinal treatment should be directed toward the relief of the engorgement and the prevention of the increase of the pathologic conditions causing it. The application of cups and leeches, which has been practised by some, is not now recommended by best authorities, although counterirritation over the liver by the use of some stimulating liniment may probably be of some slight use. The benefit derived by having the patient drink freely of hot water, say a glassful half an hour before eating, each draft to contain from two to five grains of sodium phosphate, is very considerable. The saline cathartics or laxative mineral waters are exceedingly beneficial. The patient should have from three to six liquid movements a day. To prevent the increase of connective tissue in the organ many drugs have been recommended. One of the most highly lauded is chlorid of ammonia. This should be given in doses of from two to five grains every four or five hours. It is best administered in some syrup or elixir. Probably one of the most useful agents which has stood the test of time is phosphate of soda; this should be given in doses of from five to ten grains, according to the age of the child. It is best administered in hot water, and may sometimes be disguised in soup, being used in the place of salt. Potassium iodid is said to retard the changes in the organ when given in the early stages. In cases of syphilitic origin this drug, of course, will have a particular usefulness. Small and continued doses of mercury, in the form of calomel, bichlorid, or gray powder, are valuable agents. In advanced cases, where the principal indication is the relief of the various distressing symptoms of the disease, these should be treated as they arise. Where ascites is marked, the patient should be placed on a

dry diet, principally of meat. The gastro-intestinal dyspepsia which always accompanies the malady should be treated as in other cases. Hemorrhage from the stomach or other part of the digestive tract requires rest in bed, the administration of cracked ice, and the application of an ice-bag externally. Where the hemorrhage is of gastric origin, food should be administered by rectum. Opium should always be given to quiet the patient, and may be used in either the form of morphin hypodermically or paregoric in suitable doses, administered alone or in combination with an astringent, such as sulphuric acid. The following formula, recommended by Musser, is useful in these cases:

℞. Tinct. opii camph.,
Acid. sulphuric. aromat., ... aa f℥j.
SIG.—Eight to ten drops in water every two, three, or four hours.

Various astringents, such as acetate of lead, bismuth, nitrate of silver, and many others, have been employed. Hamamelis, in doses of twenty drops every hour or two, has been employed with benefit. The various preparations of iron, particularly Monsel's salt, given in the form of a hard pill of one grain, is of use in intestinal hemorrhage. In cases of hemorrhage from the lower bowel, astringent enemata should be employed. Ascites should be treated by the administration of diuretics and saline cathartics. Drafts of cream of tartar dissolved in water are valuable for this purpose, and are rather pleasant to the patient. Infusion of scoparius has also given good results in these cases, but probably the best of all drugs for this purpose is calomel. This may be used alone, or in combination with a compound jalap powder. Copaiba gives a more permanent result. Where the child is old enough to take the drug in this form, it may be administered in the capsule containing three minims, to be taken every four hours. Where the heart is weak, caffein or digitalis should be employed, and hydrochlorate of cocain is also said to have given good results for this purpose. As in the late stages of the disease death frequently takes place from exhaustion, stimulants and cardiac tonics should be used where this condition is threatened. Paracentesis may be employed frequently. The jaundice requires no special treatment.

FATTY LIVER.

The so-called fatty liver consists in a uniform enlargement of the organ, due to its becoming infiltrated with fatty elements. As a rule, there is no actual degeneration of the true hepatic structure. It is an intercurrent affection, being associated with

gastro-intestinal catarrh, tuberculosis, or other wasting disease. The excessive use of saccharine or starchy food, particularly where associated with a sedentary life during childhood, is also an etiologic factor.

Symptoms.—There is a uniform enlargement of the liver, its surface is smooth, and palpation causes no pain. The surfaces of the organ are smooth and soft, and its edges rounded. The general symptoms are negative.

The **treatment** should consist in strict attention to the hygiene and diet. Foods containing large quantities of carbohydrates must be excluded. The patient should take plenty of outdoor exercise, or, where this is impossible, should receive massage. A large part of the treatment consists really in treating the disease from which the fatty infiltration arises.

AMYLOID DISEASE OF THE LIVER.

Synonyms.—LARDACEOUS LIVER; WAXY LIVER; SCROFULOUS LIVER; ALBUMINOUS LIVER.

Amyloid disease consists in a degeneration of the liver structure, caused by deposits of an albuminoid material the microscopic appearance of which resembles starch granules. The disease may appear at any age of childhood, and in the majority of cases occurs in the course of suppurative diseases, particularly those of a chronic nature, such as tuberculosis, especially tuberculous bone affections, syphilis, and rachitis. It is frequently associated with amyloid disease in other organs.

Pathology.—The liver presents a pale, glistening, anemic appearance and has a doughy consistency. There is a uniform enlargement of the organ. There are certain chemic tests whereby the presence of amyloid degeneration can be easily ascertained. One of these is made by first cleansing the surface of the organ and then brushing over it an aqueous solution of iodin with iodid of potassium. Wherever the deposits of amyloid substance have taken place these will assume a brownish or mahogany color, which in turn will change to violet or a bluish tint if diluted sulphuric acid is added. Another test consists in brushing the liver over with a solution of anilin violet of the strength of 1 per cent. This will produce a red or pinkish color on coming in contact with the amyloid deposits, the unaltered tissues being stained blue.

Symptoms.—Anemia is usually the most prominent symptom. There may be some prominence of the external abdominal veins.

Where jaundice is present it is slight, but in the majority of cases it does not appear. Diarrhea is generally a prominent symptom, and hemorrhage from the bowels may occur. Dyspepsia is common. Where the kidneys share in the amyloid degeneration, dropsy in various parts of the body may occur. In these cases the urine will be increased in amount and will contain albumin. Palpation will show that the liver is greatly increased in size, sometimes attaining two or three times its normal dimensions. This enlargement is uniform. The edges of the organ will be found to be round and hard, and palpation, as a rule, does not give pain. Enlargement of the spleen is generally a coincident symptom.

Diagnosis.—Amyloid disease may be suspected in any case where increase in the size of the abdomen occurs in the course of a chronic suppurative disease. In suspected cases examination of the kidneys and spleen should be made, and where these are found to share in the amyloid degeneration, diagnosis is positive. Intended surgical operations on the bones and joints should not be attempted during the course of this disease.

The **prognosis** is unfavorable; although the affection may proceed either rapidly or slowly, the termination is always fatal.

Treatment.—Outside of the fact that all effort possible should be made to bring the patient's system into as good a condition as possible by the use of tonics and the best hygienic surroundings, the treatment is largely symptomatic. Various drugs have been recommended, particularly chlorid of ammonia and syrup of the iodid of iron. Iodin has also its advocates, but in the majority of cases dependence upon any of these agents will be found to be disappointing. Efforts should be made to remove the cause as quickly as possible, especially where this arises from any suppurating disease of the bones. In cases where congestion of the hepatic or portal circulations due to cardiac weakness occurs, such drugs as digitalis, strophanthus, or other heart tonics will be found of service.

ACUTE YELLOW ATROPHY OF THE LIVER.

Yellow atrophy is very rare in childhood. At this period of life the etiologic factors are usually syphilis or poisoning from phosphorus. The disease is also known by the names of general parenchymatous hepatitis and malignant jaundice.

Pathology.—At first there is hyperemia of the hepatic cells, with a grayish exudation between the lobules; following this the cells undergo fatty degeneration. A marked reduction in the

size and weight of the organ occurs. The spleen is enlarged, and degeneration of the kidneys takes place. The urine contains bile pigments and albumin, and generally crystals of leucin and tyrosin will also be found in it. The disease is of insidious onset; there are symptoms of general malaise, accompanied by icterus. In the beginning there is a slight elevation of temperature, some pain over the epigastrium, headache, nausea, vomiting, and a coated tongue. As the disease progresses the headache becomes worse,—indeed, is generally a prominent symptom,—the pulse becomes slow, and the jaundice intense. Later, the patient shows all the symptoms of profound toxemia. There may be fever, or occasionally a subnormal temperature. The stools are black and tarry, and vomiting of black, grumous substance, the so-called coffee-grounds vomit, may occur. In the last stages the patient becomes comatose or may die in convulsions.

The **treatment** is chiefly symptomatic; efforts should be made to relieve the toxemia by hot packs, hot drinks, and the administration of calomel or other agents that will act on the liver. Diuresis should be encouraged. Small doses of phosphorus have been recommended, but have so far proved of no avail.

HYDATID DISEASE.

Although hydatid disease is a rare affection, it is occasionally seen in children. The methods of infection are the same as in the adult. The first symptom noticed is generally enlargement of the abdomen, the tumor being greatest in size in the region of the liver. This enlargement of the hepatic region may be general, although usually the greatest amount of swelling corresponds to the position of the cyst. If this is situated on the convex side of the liver, percussion will demonstrate that the normal area of dullness extends higher in the axillary region in front and in the scapular regions behind. If the cyst is situated in the right lobe, dullness will be found to extend downward toward the umbilicus, and when in the left lobe, examination will reveal the presence of the greatest amount of swelling in the epigastric region. The tumor is usually painless, and percussion over it will cause little or no discomfort. Fluctuation may be found, and occasionally the symptom known as hydatid fremitus may be detected by placing one hand over the tumor and forcibly and quickly tapping another part of the tumor with the other hand. There is generally little or no deterioration in the general health so long as the cyst remains unruptured or there is no great pressure upon the hepatic duct. Jaundice is either slight or, where it does

appear, it develops slowly. Rupture of the cyst is generally followed by symptoms of pyemia, and whenever in the course of development of a hydatid cyst periodic elevations of temperature arise, these being preceded by rigors and followed by sweats and general prostration, rupture of the cyst can generally be diagnosticated. This rupture may take place into the hepatic duct or, in some cases, into the surrounding organs, such as the pleura, colon, bronchi, or even into the pericardium or vena cava.

The **diagnosis** is principally made from the character of the enlargement of the liver. An irregular increase in size, the presence of fluctuation, the absence of pain on palpation, and the continuance of a fairly good condition of general health serve as diagnostic points. From hepatic syphilis hydatid disease must be distinguished by the fact that in the former the enlargement, although present, is irregular, the liver is harder, and some of the general symptoms of specific disease will be present. The diagnosis between hydatid cysts and abscess of the liver is often one of extreme difficulty. In abscess there is usually a history of traumatism ; there are pain and tenderness over the liver, and the general symptoms are more rapid in their onset. Hydronephrosis may in some cases be mistaken for hydatid disease, but the former is very rare in children. When doubt exists, an exploratory puncture will aid in diagnosis. Affections of the pleura may be in some cases confounded with hydatid disease, and the diagnosis may be rendered particularly difficult where a cyst has ruptured into the right pleural cavity. In the latter case probably the only point of differentiation will be the presence of the hooklets of the echinococcus in the sputum.

The **prognosis** is variable. A fair number of cases will probably go for years with one or more of these cysts gradually developing in the liver. Indeed, cases have been reported in which spontaneous cure has occurred. When the cyst is in such position that it can be attacked by operative measures, its removal is recommended by most authorities.

Treatment.—It is generally considered that the best results in treatment are obtained by surgical means. The abdomen should be opened at the most prominent part of the tumor, and the cyst evacuated. If any small cysts exist, they should be carefully emptied at the same time and a thorough irrigation of the abdominal cavity should be practised. It is generally recommended that the drainage-tube be left in the incision. Great care must be taken to remove every part of the cyst, as suppuration will take place if any portion of the original cyst or daughter cysts is allowed to remain. Where the cyst is situated in the

upper surface of the liver, it is sometimes necessary to open it through the diaphragm; in this case one or two ribs must be resected and the pleura stitched to the diaphragm.

Electricity and injections into the cyst have been tried, but have not met with much success. In cases where, for any reason, laparotomy can not be done, it has been advised by some that the cyst be opened by means of a large trocar and cannula, and a drainage-tube inserted through the latter. Simon's method consists in passing needles into the tumor, so as to cause an adhesive inflammation, and then later to practise incision. Aspiration has also been followed by temporary success and has been recommended by Dieulafoy and Murchison. Even after operative treatment recurrence may take place, even as late as two or three years after incision, as in two cases reported by Morris. Biliary fistula is also one of the secondary dangers of operative treatment, and cases of this have been recorded.

CHAPTER VIII.

DISEASES OF THE GENITO-URINARY SYSTEM.

THE URINE.

Before the time at which a child may have acquired regular habits of urination the most practicable way to procure a specimen of urine for examination is by means of a soft catheter. When this is undesirable or impossible, the child may be placed at short intervals upon the chamber, and hot or cold applications made over the bladder or sacrum to encourage micturition.

The urine may sometimes be caught in small quantities in a cloth or pledget of cotton fastened over the penis or vagina, or, as Holt recommends, a small condom or bottle suspended in such a way that the penis may be introduced into it.

The Quantity.—The quantity, as in adults, varies between wide limits, depending upon the amount and quality of the food ingested and according as a small or a large quantity of water is carried off by way of the skin or the bowels.

AVERAGE QUANTITY OF URINE PER DIEM IN CHILDHOOD.*

First 24 hours,	0 to	60	grams	(0 to 2	ounces)
Second 24 hours,	10 "	90	"	(⅓ to 3	ounces)
3 to 6 days,	90 "	250	"	(3 to 8	ounces)
7 days to 2 months,	150 "	400	"	(5 to 13	ounces)
2 to 6 months,	210 "	500	"	(7 to 16	ounces)
6 months to 2 years,	250 "	600	"	(8 to 20	ounces)
2 to 5 years,	500 "	800	"	(16 to 26	ounces)
5 to 8 years,	600 "	1200	"	(20 to 40	ounces)
8 to 14 years,	1000 "	1500	"	(32 to 48	ounces).

Up to about the third year a healthy infant while awake passes its urine at frequent intervals, often every half-hour or so, but when lying quietly and asleep may retain it for a much longer time—even for five or six hours. During the second year the child retains its urine an hour or so longer, and so, as its age

* This and the following table have been compiled by Emmet Holt from statistics given by Schatanowa, Cruse, Camerer, Pollak, Martin-Ruge, Berti, Schiff, and Herter.

Symptoms.—In the beginning the symptoms are very apt to be confounded with those of ordinary hepatic congestion arising from disturbances of the digestive tract. There are nausea and vomiting or attempts to vomit, these occurring particularly in the morning. The vomited matter consists largely of mucus. The bowels are irregular, being sometimes constipated, while at others attacks of diarrhea may occur. The stools contain considerable mucus. Hemorrhages may take place from the nose, mouth, esophagus, stomach, or intestines, and purpuric spots are occasionally seen in different parts of the body. Dilatation of the subcutaneous abdominal veins very frequently occurs. The face is pale or of a sallow hue, and numerous stigmata, composed of groups of minute veins, are seen upon it. There is a slight amount of jaundice. This may be constant, although the attacks are very apt to recur. A moderate amount of ascites is almost invariably seen, and not infrequently this may be one of the prominent symptoms of the disease. From obstruction to the portal system there is dilatation of the veins, large and small, particularly the superficial veins of the thorax or abdomen. Not infrequently a well-defined arch is seen extending across the chest, marking the attachment of the diaphragm. The superficial abdominal veins are also in many cases fairly outlined. Enlargement of the spleen frequently occurs. The temperature in the early stages is moderately elevated, a rise of two or three degrees being usual—101° to 102° F. (38.3° to 38.9° C.). This is most commonly observed in the evening. As the disease progresses, however, a subnormal temperature is the most common. The urine is of high specific gravity and contains large quantities of uric acid and urates. If nephritis develops, which it very frequently does during the course of the disease, the urine will become albuminous and will be found, on microscopic examination, to contain granular and hyaline casts. Traces of sugar will sometimes be seen. During the first stage the liver enlarges, but later steadily diminishes in size, this decrease being particularly noticeable in the left lobe. While dropsy usually seen in this disease is abdominal, yet in a certain number of cases swelling of the lower extremities may take place. In the late stages of the disease the mind becomes clouded, largely from retention of the various products of excretion, the patient becoming first dull, and later passing into coma or active delirium. Convulsions may occur.

Pathology.—In the *first stage* there is hyperemia of the connective tissue of the liver, followed by the development of the connective-tissue elements, causing an increase in size and density

of the organ. From this hypertrophy of the connective tissue pressure is made upon the true hepatic cells, causing them to undergo fatty degeneration. In the *second stage* the imperfectly developed connective tissue contracts, causing the organ to decrease in size, and producing induration. Its surfaces become nodulated, thus giving the liver the appearance which is usually characterized by the term "hobnail." Obstruction to the portal and hepatic circulations soon occurs.

The **diagnosis** is to be based upon the physical signs, the symptoms of portal obstruction, and the characteristic appearance of the face. The diseases with which cirrhosis is most likely to be confounded are, first, atrophy of the liver; but cirrhosis most commonly follows obstructive diseases of the heart or lungs. In atrophy no nodulation of the organ occurs, and the history of alcoholism or syphilis is generally wanting. Second, cirrhosis must be differentiated from tubercular peritonitis; in this disease the abdominal tenderness is general; there is rapidly developing ascites, absence of jaundice, and, in the majority of cases, the symptoms of gastro-intestinal dyspepsia are absent. On percussion the liver will be found to be normal. There are also, as a general rule, evidences of tuberculosis in other organs of the body. Cancer of the peritoneum may have some symptoms resembling those of perihepatitis, but this disease occurs very rarely in childhood. The liver will be found normal upon examination, and there will be other symptoms characteristic of cancerous disease.

The **prognosis** is very unfavorable.

Treatment.—The indications for treatment are, first, to remove the causes; second, to prevent, so far as possible, the increase of connective-tissue growth, and to relieve the engorgement of the hepatic and portal circulation. Third, if the case is too far advanced for cure, we must then endeavor to relieve the symptoms as they arise. In order to meet the first indication the causes of irritation must be removed. The patient should be allowed no alcohol in any form; all highly seasoned, fatty, or saccharine foods must be given up, and even articles of food containing starch must be used with great caution. The diet should consist principally of the lighter meats, such as the white meat of chicken or turkey, although other animal diet may be employed in moderation. To better insure its digestion it is well to have the meat finely chopped, and made into the form of a meat ball, without fat, and carefully browned. As a continuous animal diet may tend to cause scorbutus, doses of lemon-juice or diluted citric acid must be administered occasionally to counter-

act this tendency. Eggs may also be employed as an article of diet.

Probably the best food for these cases is milk,—either the best dairy milk, skimmed, or buttermilk may be used,—or in some cases where the patient tires of this article of food, which is generally the case in a short time, it may be administered in the form of various desserts, such as junket, blanc mange, or light puddings. The tendency to constipation must be corrected by the administration of alkaline aperient waters, such as Hunyadi, Saratoga, or Carlsbad. Vegetables such as spinach, lettuce, or those containing little or no starch may be allowed, but potatoes, rice, and other vegetables containing much starch should be used sparingly, if at all. The question of dress is of some importance. The patient should wear flannel next to the skin the year round, and should dress warmly enough to avoid chilling. An outdoor life in the open air is best for these cases. The medicinal treatment should be directed toward the relief of the engorgement and the prevention of the increase of the pathologic conditions causing it. The application of cups and leeches, which has been practised by some, is not now recommended by best authorities, although counterirritation over the liver by the use of some stimulating liniment may probably be of some slight use. The benefit derived by having the patient drink freely of hot water, say a glassful half an hour before eating, each draft to contain from two to five grains of sodium phosphate, is very considerable. The saline cathartics or laxative mineral waters are exceedingly beneficial. The patient should have from three to six liquid movements a day. To prevent the increase of connective tissue in the organ many drugs have been recommended. One of the most highly lauded is chlorid of ammonia. This should be given in doses of from two to five grains every four or five hours. It is best administered in some syrup or elixir. Probably one of the most useful agents which has stood the test of time is phosphate of soda; this should be given in doses of from five to ten grains, according to the age of the child. It is best administered in hot water, and may sometimes be disguised in soup, being used in the place of salt. Potassium iodid is said to retard the changes in the organ when given in the early stages. In cases of syphilitic origin this drug, of course, will have a particular usefulness. Small and continued doses of mercury, in the form of calomel, bichlorid, or gray powder, are valuable agents. In advanced cases, where the principal indication is the relief of the various distressing symptoms of the disease, these should be treated as they arise. Where ascites is marked, the patient should be placed on a

dry diet, principally of meat. The gastro-intestinal dyspepsia which always accompanies the malady should be treated as in other cases. Hemorrhage from the stomach or other part of the digestive tract requires rest in bed, the administration of cracked ice, and the application of an ice-bag externally. Where the hemorrhage is of gastric origin, food should be administered by rectum. Opium should always be given to quiet the patient, and may be used in either the form of morphin hypodermically or paregoric in suitable doses, administered alone or in combination with an astringent, such as sulphuric acid. The following formula, recommended by Musser, is useful in these cases:

℞. Tinct. opii camph.,
Acid. sulphuric. aromat., ... aa f℥j.
SIG.—Eight to ten drops in water every two, three, or four hours.

Various astringents, such as acetate of lead, bismuth, nitrate of silver, and many others, have been employed. Hamamelis, in doses of twenty drops every hour or two, has been employed with benefit. The various preparations of iron, particularly Monsel's salt, given in the form of a hard pill of one grain, is of use in intestinal hemorrhage. In cases of hemorrhage from the lower bowel, astringent enemata should be employed. Ascites should be treated by the administration of diuretics and saline cathartics. Drafts of cream of tartar dissolved in water are valuable for this purpose, and are rather pleasant to the patient. Infusion of scoparius has also given good results in these cases, but probably the best of all drugs for this purpose is calomel. This may be used alone, or in combination with a compound jalap powder. Copaiba gives a more permanent result. Where the child is old enough to take the drug in this form, it may be administered in the capsule containing three minims, to be taken every four hours. Where the heart is weak, caffein or digitalis should be employed, and hydrochlorate of cocain is also said to have given good results for this purpose. As in the late stages of the disease death frequently takes place from exhaustion, stimulants and cardiac tonics should be used where this condition is threatened. Paracentesis may be employed frequently. The jaundice requires no special treatment.

FATTY LIVER.

The so-called fatty liver consists in a uniform enlargement of the organ, due to its becoming infiltrated with fatty elements. As a rule, there is no actual degeneration of the true hepatic structure. It is an intercurrent affection, being associated with

gastro-intestinal catarrh, tuberculosis, or other wasting disease. The excessive use of saccharine or starchy food, particularly where associated with a sedentary life during childhood, is also an etiologic factor.

Symptoms.—There is a uniform enlargement of the liver, its surface is smooth, and palpation causes no pain. The surfaces of the organ are smooth and soft, and its edges rounded. The general symptoms are negative.

The **treatment** should consist in strict attention to the hygiene and diet. Foods containing large quantities of carbohydrates must be excluded. The patient should take plenty of outdoor exercise, or, where this is impossible, should receive massage. A large part of the treatment consists really in treating the disease from which the fatty infiltration arises.

AMYLOID DISEASE OF THE LIVER.

Synonyms.—LARDACEOUS LIVER; WAXY LIVER; SCROFULOUS LIVER; ALBUMINOUS LIVER.

Amyloid disease consists in a degeneration of the liver structure, caused by deposits of an albuminoid material the microscopic appearance of which resembles starch granules. The disease may appear at any age of childhood, and in the majority of cases occurs in the course of suppurative diseases, particularly those of a chronic nature, such as tuberculosis, especially tuberculous bone affections, syphilis, and rachitis. It is frequently associated with amyloid disease in other organs.

Pathology.—The liver presents a pale, glistening, anemic appearance and has a doughy consistency. There is a uniform enlargement of the organ. There are certain chemic tests whereby the presence of amyloid degeneration can be easily ascertained. One of these is made by first cleansing the surface of the organ and then brushing over it an aqueous solution of iodin with iodid of potassium. Wherever the deposits of amyloid substance have taken place these will assume a brownish or mahogany color, which in turn will change to violet or a bluish tint if diluted sulphuric acid is added. Another test consists in brushing the liver over with a solution of anilin violet of the strength of 1 per cent. This will produce a red or pinkish color on coming in contact with the amyloid deposits, the unaltered tissues being stained blue.

Symptoms.—Anemia is usually the most prominent symptom. There may be some prominence of the external abdominal veins.

Where jaundice is present it is slight, but in the majority of cases it does not appear. Diarrhea is generally a prominent symptom, and hemorrhage from the bowels may occur. Dyspepsia is common. Where the kidneys share in the amyloid degeneration, dropsy in various parts of the body may occur. In these cases the urine will be increased in amount and will contain albumin. Palpation will show that the liver is greatly increased in size, sometimes attaining two or three times its normal dimensions. This enlargement is uniform. The edges of the organ will be found to be round and hard, and palpation, as a rule, does not give pain. Enlargement of the spleen is generally a coincident symptom.

Diagnosis.—Amyloid disease may be suspected in any case where increase in the size of the abdomen occurs in the course of a chronic suppurative disease. In suspected cases examination of the kidneys and spleen should be made, and where these are found to share in the amyloid degeneration, diagnosis is positive. Intended surgical operations on the bones and joints should not be attempted during the course of this disease.

The **prognosis** is unfavorable; although the affection may proceed either rapidly or slowly, the termination is always fatal.

Treatment.—Outside of the fact that all effort possible should be made to bring the patient's system into as good a condition as possible by the use of tonics and the best hygienic surroundings, the treatment is largely symptomatic. Various drugs have been recommended, particularly chlorid of ammonia and syrup of the jodid of iron. Iodin has also its advocates, but in the majority of cases dependence upon any of these agents will be found to be disappointing. Efforts should be made to remove the cause as quickly as possible, especially where this arises from any suppurating disease of the bones. In cases where congestion of the hepatic or portal circulations due to cardiac weakness occurs, such drugs as digitalis, strophanthus, or other heart tonics will be found of service.

ACUTE YELLOW ATROPHY OF THE LIVER.

Yellow atrophy is very rare in childhood. At this period of life the etiologic factors are usually syphilis or poisoning from phosphorus. The disease is also known by the names of general parenchymatous hepatitis and malignant jaundice.

Pathology.—At first there is hyperemia of the hepatic cells, with a grayish exudation between the lobules; following this the cells undergo fatty degeneration. A marked reduction in the

size and weight of the organ occurs. The spleen is enlarged, and degeneration of the kidneys takes place. The urine contains bile pigments and albumin, and generally crystals of leucin and tyrosin will also be found in it. The disease is of insidious onset; there are symptoms of general malaise, accompanied by icterus. In the beginning there is a slight elevation of temperature, some pain over the epigastrium, headache, nausea, vomiting, and a coated tongue. As the disease progresses the headache becomes worse,—indeed, is generally a prominent symptom,—the pulse becomes slow, and the jaundice intense. Later, the patient shows all the symptoms of profound toxemia. There may be fever, or occasionally a subnormal temperature. The stools are black and tarry, and vomiting of black, grumous substance, the so-called coffee-grounds vomit, may occur. In the last stages the patient becomes comatose or may die in convulsions.

The **treatment** is chiefly symptomatic; efforts should be made to relieve the toxemia by hot packs, hot drinks, and the administration of calomel or other agents that will act on the liver. Diuresis should be encouraged. Small doses of phosphorus have been recommended, but have so far proved of no avail.

HYDATID DISEASE.

Although hydatid disease is a rare affection, it is occasionally seen in children. The methods of infection are the same as in the adult. The first symptom noticed is generally enlargement of the abdomen, the tumor being greatest in size in the region of the liver. This enlargement of the hepatic region may be general, although usually the greatest amount of swelling corresponds to the position of the cyst. If this is situated on the convex side of the liver, percussion will demonstrate that the normal area of dullness extends higher in the axillary region in front and in the scapular regions behind. If the cyst is situated in the right lobe, dullness will be found to extend downward toward the umbilicus, and when in the left lobe, examination will reveal the presence of the greatest amount of swelling in the epigastric region. The tumor is usually painless, and percussion over it will cause little or no discomfort. Fluctuation may be found, and occasionally the symptom known as hydatid fremitus may be detected by placing one hand over the tumor and forcibly and quickly tapping another part of the tumor with the other hand. There is generally little or no deterioration in the general health so long as the cyst remains unruptured or there is no great pressure upon the hepatic duct. Jaundice is either slight or, where it does

appear, it develops slowly. Rupture of the cyst is generally followed by symptoms of pyemia, and whenever in the course of development of a hydatid cyst periodic elevations of temperature arise, these being preceded by rigors and followed by sweats and general prostration, rupture of the cyst can generally be diagnosticated. This rupture may take place into the hepatic duct or, in some cases, into the surrounding organs, such as the pleura, colon, bronchi, or even into the pericardium or vena cava.

The **diagnosis** is principally made from the character of the enlargement of the liver. An irregular increase in size, the presence of fluctuation, the absence of pain on palpation, and the continuance of a fairly good condition of general health serve as diagnostic points. From hepatic syphilis hydatid disease must be distinguished by the fact that in the former the enlargement, although present, is irregular, the liver is harder, and some of the general symptoms of specific disease will be present. The diagnosis between hydatid cysts and abscess of the liver is often one of extreme difficulty. In abscess there is usually a history of traumatism; there are pain and tenderness over the liver, and the general symptoms are more rapid in their onset. Hydronephrosis may in some cases be mistaken for hydatid disease, but the former is very rare in children. When doubt exists, an exploratory puncture will aid in diagnosis. Affections of the pleura may be in some cases confounded with hydatid disease, and the diagnosis may be rendered particularly difficult where a cyst has ruptured into the right pleural cavity. In the latter case probably the only point of differentiation will be the presence of the hooklets of the echinococcus in the sputum.

The **prognosis** is variable. A fair number of cases will probably go for years with one or more of these cysts gradually developing in the liver. Indeed, cases have been reported in which spontaneous cure has occurred. When the cyst is in such position that it can be attacked by operative measures, its removal is recommended by most authorities.

Treatment.—It is generally considered that the best results in treatment are obtained by surgical means. The abdomen should be opened at the most prominent part of the tumor, and the cyst evacuated. If any small cysts exist, they should be carefully emptied at the same time and a thorough irrigation of the abdominal cavity should be practised. It is generally recommended that the drainage-tube be left in the incision. Great care must be taken to remove every part of the cyst, as suppuration will take place if any portion of the original cyst or daughter cysts is allowed to remain. Where the cyst is situated in the

upper surface of the liver, it is sometimes necessary to open it through the diaphragm; in this case one or two ribs must be resected and the pleura stitched to the diaphragm.

Electricity and injections into the cyst have been tried, but have not met with much success. In cases where, for any reason, laparotomy can not be done, it has been advised by some that the cyst be opened by means of a large trocar and cannula, and a drainage-tube inserted through the latter. Simon's method consists in passing needles into the tumor, so as to cause an adhesive inflammation, and then later to practise incision. Aspiration has also been followed by temporary success and has been recommended by Dieulafoy and Murchison. Even after operative treatment recurrence may take place, even as late as two or three years after incision, as in two cases reported by Morris. Biliary fistula is also one of the secondary dangers of operative treatment, and cases of this have been recorded.

advances, the frequency of urination gradually diminishes to the average of adult life.

During the first few days after birth the urine is highly colored, strongly acid in reaction, precipitating in comparatively large quantity uric acid and urates; later it becomes paler, of lower specific gravity, but still may be cloudy from the presence of urates and mucus. Hyaline and granular casts may also be found in the new-born (Martin-Ruge). Virchow was the first to show the presence of albumin also at this period.

AVERAGE SPECIFIC GRAVITY OF URINE IN CHILDHOOD.

1 to 3 days,	1.010 to 1.012
4 to 10 days,	1.004 to 1.008
10 days to 6 months,	1.004 to 1.010
6 months to 2 years,	1.006 to 1.012
2 to 8 years,	1.008 to 1.016
8 to 14 years,	1.012 to 1.020.

The phosphates, chlorids, and sulphates are reduced in proportion, gradually increasing in amount with the age.

AVERAGE EXCRETION OF UREA PER DIEM IN CHILDHOOD.

First day,	0.076 to 0.114 grams.
2 to 7 days,	0.14 " 0.66 "
1 to 2 months,	0.9 " 1.4 "
3 to 5 years,	13.09 " 14.01 "
5 to 13 years,	16.05 " 21.03 "

RATIO OF UREA TO URIC ACID.—(*Herter.*)

New-born,*	14 to 1
First year,	60–80 " 1
2 to 5 years,	50–70 " 1
5 to 15 years,	45–60 " 1.

ANURIA.

Definition.—Anuria is a complete cessation of the secretion of urine by the kidneys.

Causes.—In rare instances it may be the result of congenital malformation of some portion of the urinary tract. It may occur in the course of fevers or acute Bright's disease, but here there is more often only an oliguria. Some of the commoner causes are hysteria, shock from fright, traumatism, or operations, after the passage of a catheter or the administration of ether or chloroform, certain poisons, such as arsenic, turpentine, lead, and phosphorus. In collapse during typhoid fever there may be no

* From Martin-Ruge.

urine secreted for some time. It may be due to the presence of a calculus blocking one or both ureters.

Prognosis.—It will often be seen in infants, when, after a period as long even as twenty hours, the urine will again make its appearance and with the development of no serious symptoms.

As to the length of time a patient may live with absolute suppression of the urine, Herter collected a series of cases in which recovery occurred after periods ranging from four to fourteen days, and Bailey reports an instance of a young girl where, so far as the author could tell, urine was passed but once from October 10th to March 1st. Some doubt, however, is expressed as to the truth of the patient's statements.

Treatment.—When the cause is removable, it will receive the first consideration, and the treatment of the condition should be the application of cups or hot fomentations over the kidneys, free administration of purgatives and diaphoretics, followed by diuretics. Large hot irrigations with normal salt solution should be tried, as they stimulate the activity of the kidney in a remarkable way (Osler).

POLYURIA.

Definition.—Polyuria is a temporary increase in the secretion of urine.

Causes.—It is produced by drinking large quantities of water, by hysteria or fright, exposure to cold, and by diuretics; it appears in certain forms of Bright's disease and brain lesions, at times in convulsions and acute febrile diseases, and with the resorption of large serous effusions.

Diagnosis.—It is to be distinguished from diabetes insipidus in that the latter shows a tendency to become chronic in type, and is apt to be associated with changes that are organic rather than functional.

PHYSIOLOGIC GLYCOSURIA.

Glucose is now generally considered to be a constituent of normal urine, but in quantity too small to show a reaction with the older tests, such as Fehling's, etc., but responding to the phenylhydrazin test. This is of no clinical significance, and therefore phenylhydrazin is inadvisable for ordinary use. It occurs sometimes, however, in the urine of otherwise healthy children, probably from some faulty metabolism. Sugar, in the form of lactose, is often found in infancy and childhood, and is derived from the milk.

INDICANURIA.

Indol is a product of the putrefaction of albumin from the action of bacteria. It is absorbed and oxidized to indoxyl within the system, where it unites with the sulphuric acid, forming indoxyl-sulphuric acid. The salt of indoxyl-sulphuric acid with which we have to do is the indoxyl-sulphate of potassium (indican). Another substance, indirubin, allied to indican and giving a red color with the same test, is also found, but its clinical significance is unknown.

Indican in very small quantity may normally be found in the urine, seeming to depend upon the character of the food ingested, being increased by an animal diet; but when much exists, it is always pathologic.

Causes.—Indican may be found whenever there is any large accumulation of putrid (not laudable) pus in the body, and when this has been excluded, its presence may be taken to indicate an excessive putrefaction of proteids in the intestine; by far its most frequent source. As an instance of the former may be mentioned gangrenous processes, empyema, and peritonitis, in which it is often a grave prognostic sign. According to Daland, absence of indicanuria almost precludes a diagnosis of peritonitis.

Hochsinger failed to find it in the new-born, and in healthy infants only in traces. He found it in large quantity in most intestinal disturbances, and "always when they were accompanied with acute diarrhea; also in tuberculosis, whether involving the intestinal tract or not." He, as well as Gehlig, ascribed it to the putrefaction of milk albumin in the intestines.

Singer speaks of its presence in urticaria and other skin diseases. Epilepsy, particularly at the time of seizure, and masturbation are said by Herter to be frequently accompanied with indicanuria. The most common conditions, however, with which it is associated are chronic intestinal indigestion and constipation.

Test.—Stokvis' modification of Jaffé's test, performed in the following manner, will serve not only as a qualitative, but as a fairly accurate quantitative, test for clinical purposes:

Urine and hydrochloric acid in equal parts are put into a test-tube, to which is added a small quantity of chloroform, *care being taken always to use the same relative quantity of urine, hydrochloric acid, and chloroform; for in this way only can the shades of color of the chloroform as it may vary in different examinations be taken as a guide to the increase or decrease of indican.*

To this is added some oxidizing agent, such as Labarraque's solution or solution of sodium hypochlorite, to liberate the indigo; this is then taken up by the chloroform, which assumes a blue color varying in intensity according to the amount of indican present in the urine.

The oxidizing agent should be added one drop at a time, and the test-tube thoroughly shaken, then allowed to stand a few moments for the reaction to take place before adding another, for if used too rapidly, the blue color will be bleached when there is only a small quantity of indican present. Slowly in this way all the indigo should be thrown down.

The end of the action may be recognized by the blue color just beginning to fade. If only a trace of indican be present, the chloroform may remain white after the first drop of hypochlorite, when another test should be made, using only the chloroform, and if this fails to show any trace of color, the tube may be set aside for some hours, when it will often be found to show distinctly.

Precaution.—Care must be taken to remove any albumin present before applying the test, as it sometimes gives a blue color with hydrochloric acid (Halliburton). Bile also gives a muddy, greenish-blue color to the indican reaction. In decomposed urine the indican may be destroyed. The urine of patients taking bromids or iodids will show with these reagents a somewhat similar reaction, the difference being that in the case of the iodids the chloroform is colored a yellowish red, and in the bromids a reddish-violet tint.

Treatment.—The indications for treatment are to control the putrefactive process going on in the intestinal tract.

ACETONURIA.

Acetone has been shown by von Jaksch to be derived from the proteids both of the body and of the food. It occurs in normal urine only in traces, but pathologically may be found in large quantity in many diseased conditions. Most commonly it is seen accompanying the fevers and derangements of digestion, but may be present during starvation, with psychoses (Wagner), as an autointoxication, in advanced stages of diabetes mellitus, and, according to von Jaksch and others, it is of special significance in cases of grave cerebral irritation.

Diacetic Acid.—Diacetic acid never occurs in normal urine, but, contrary to the case in adults, it often makes its appearance in fevers, when it is of no serious import. When, however, it is

present in diabetes, it is generally a warning of the approach of coma. It is by some held that acetone gives rise to no symptoms, but that they are due to diacetic and oxybutyric acids.

PYURIA.

Pus may come from any part of the urinary tract, or, in rare cases, from a perinephritic or perityphlitic abscess opening into some portion of it, but in children its most frequent source is the bladder or the pelvis of the kidney. If from the pelvis, the pus is apt to be in large quantity and perhaps intermittent, but if due to calculus or to tuberculous pyelitis it is continuous. The urine is usually acid in pyelitis, whereas in cystitis it is alkaline and in smaller quantity. Moreover, there will be the characteristic symptoms of cystitis, and washing out the bladder will remove any doubt that may still exist. If from the urethra or vagina, the local symptoms will plainly show its origin.

When the pus comes from a source outside of the urinary tract and opening into it, there will generally be local or constitutional symptoms of its formation, followed by its *sudden* appearance in the urine, and rapidly disappearing within a few days.

The **treatment** is merely that of the cause.

HEMATURIA.

Definition.—Hematuria is the presence in the urine of red blood-corpuscles.

Causes.—It may result from the use of drugs, as turpentine, cantharides, and carbolic acid; in hemorrhagic disease of the new-born, hemophilia, purpura, scurvy, rickets, scarlatina, typhoid fever, variola, leukemia, malaria, influenza, filaria sanguinis hominis, acute inflammation and congestion, tuberculosis, abscess, and tumors of the *kidneys*, and in renal infarction and calculus; also from any affection or injury of the urinary tract, such as the passage of stone along the *ureters*, the presence in the *bladder* of tumor, stone, or ulceration, and from the *urethra* in gonorrhea, passage of stone, or use of the catheter.

Urine.—The color of the urine may vary from normal to dark red, depending, of course, upon the amount of blood present. The corpuscles may be intimately mixed with the urine, or when this is not the case, may, after the urine has been allowed to stand for some time, settle to the bottom of the vessel, forming a distinct layer.

Under the microscope the corpuscles may appear normal in color and shape, or their form may be totally changed and the color gone, appearing only as faint yellowish rings.

These variations help to distinguish the different causes which lead to their appearance in the urine and the portion of the urinary tract in which the hemorrhage has occurred. They are only significant, however, when taken in conjunction with the clinical symptoms and a further examination of the urine.

Location of Hemorrhage.—When the blood is in comparatively large quantity, forming, with the urine, a uniform smoky or reddish-brown tint, the corpuscles not separating out and settling to the bottom of the vessel in a more or less well-defined stratum, the hemorrhage may be considered to have taken place in the ureters, pelvis of the kidney, or in the kidney itself; while, on the other hand, when it is from the bladder or urethra, the blood is brighter in color and not thoroughly mixed with the urine.

Kidneys.—The urine is generally acid in reaction, of lower specific gravity, and of homogeneous, hazy or dark, color, previously referred to, with perhaps long narrow molds of the ureters. The microscope will show renal epithelium and casts, particularly blood-casts; the blood-corpuscles are variously altered.

Von Jaksch says that when the blood-cells are found to be intimately mixed with the urine and not forming a sediment after standing for some hours, but deeply coloring the urine, and the corpuscles under the microscope appear profoundly altered and the coloring-matter is lost, they probably come from the kidneys themselves, and the symptoms point to acute nephritis or an exacerbation of chronic nephritis. When they appear as few attenuated and washed-out rings, they may have originated in congestive states or in miliary tuberculosis of the kidneys, in conjunction, of course, with other symptoms.

To distinguish between hemorrhage from the *pelvis* or *ureters* is sometimes very difficult. Here the urine is generally alkaline, and characteristic epithelium must be looked for under the microscope, together with the physical signs and symptoms. There may also be clots, molded in the shape of the ureters or pelvis.

The Bladder.—The blood is brighter in color, clots are more frequent, and the urine is alkaline. The most common cause is calculus, and the blood will be found little, if any, changed from normal, and often coming only at the end of micturition. When ulceration in cystitis gives rise to the hemorrhage, there will be the characteristic symptoms of cystitis: ammoniacal urine, mucopus, etc.

If uncertainty still exist, the bladder may be washed out, and when, after repeated washings, the fluid comes clear and free from blood, it may be assumed that the source is higher up. The cystoscope may be used, and also catheterization of the ureters resorted to.

In any case, however, the other physical signs and clinical symptoms must be considered before making a positive diagnosis.

Diagnosis.—Heller's and Almén's tests, together with the appearance of red blood-corpuscles under the microscope, should prevent any mistake in the diagnosis of hematuria.

Treatment.—The treatment is directed to the cause, and is the same as in the adult.

Frequently in children, when the hematuria is of renal origin, recovery takes place without treatment of any kind except rest.

HEMOGLOBINURIA.

Definition.—Hemoglobinuria is the presence in the urine of blood pigment.

Causes.—The destruction of the red blood-corpuscles, setting free, in the blood, their coloring-matter, and thence its passage into the urine, is caused by poisons, such as potassium chlorate, carbolic acid, CO_2, etc., and in certain diseases: malaria, scarlatina, scurvy, purpura, typhoid fever, yellow fever, and syphilis. There is also an epidemic hemoglobinuria of the new-born (Winckel's disease) and a paroxysmal hemoglobinuria—a periodic appearance in the urine of blood pigment without traceable cause. It may sometimes result from burns, exposure to severe cold, and violent exercise.

Diagnosis.—The urine is smoky or even reddish brown or black in color, acid in reaction, and albuminous. The microscope will reveal masses of pigment and perhaps a few corpuscles, pale in color, but more often they will be absent. The urates also may be stained dark. The spectroscope will give the characteristic absorption bands of methemoglobin or oxyhemoglobin, or both.

Treatment.—Treatment is unsatisfactory, but should be directed to the cause, and rest enforced. Amyl nitrite may at times be of service.

ENURESIS.

Synonym.—Incontinence of Urine.

Definition.—Enuresis is a condition in which the urine is involuntarily discharged from the bladder. It may appear either

during the day or night, or both. It may be periodic or continuous. During early infancy—that is, before the termination of the first year of life—enuresis may be described as a physiologic condition, the young infant possessing no control over the bladder. After this time, for a varying period dependent upon the means employed to teach the child to control its bladder, the urine will be evacuated at stated intervals, and the involuntary emptying of the bladder may be regarded as a symptom of some pathologic condition.

Causes.—These may be described as organic and functional. Among the former we have malformations of the kidneys, ureters, or bladder, or inflammations of any of these organs. Involuntary evacuation of urine may also be a symptom of various lesions of the brain or spinal cord. In the largest number of cases enuresis is a symptom of innutrition or malnutrition or some disturbance of the equilibrium of metabolism, and symptoms of such disturbances are present in a large number of cases. Instances of this may be found in rachitis or scrofulosis, or, secondarily, may be the results of these conditions or of renal or cardiac disease. In another group the evidences are less pronounced, and in this class we may have intestinal disease, lithuria, or polyuria. In a third class the exciting cause may be more obscure, or may manifest itself simply in a disturbance of the nervous equilibrium, shown as a mild or a severe neurosis. In this class of cases many facts the result of clinical observation or physiologic research lead us to look for the causes of such disturbances in the highly sensitive nerve-cells.

The physiology of micturition may be described as follows: When the bladder becomes full, an impulse passes up to the cerebral center (see diagram, p. 293); an inhibitory impulse is then despatched to the sphincter center in the fourth lumbar segment. The impulse then passes out to the sphincter urethræ, that muscle is relaxed, and the patient voluntarily contracts the abdominal walls, squeezing a few drops into the urethra. These drops generate afferent impulses which pass to another center in the lumbar cord—viz., the motor center for the bladder-walls, or the "detrusor center." Afferent impulses continue, and micturition goes on as a reflex act. It is evident that if we cut off the cerebral arc, we would have the condition seen in enuresis. This, indeed, is the condition found in the idiot or imbecile, or in children in whom a lesion of the sensory or motor portions of the cord exists. In the majority of cases it is probable that the sphincter center in the fourth lumbar segment is at fault (James H. McKee). When the act of evacuation of the

bladder occurs during sleep, at which time the inhibitory influence of the will is in abeyance, the physiology of enuresis is, to some extent, the same as when the cerebral part of the nervous system is at fault through other causes. In some cases the patient may dream of the act, and the evacuation may occur during this dream. At other times the bladder may be emptied without any knowledge of the patient. In the majority of cases

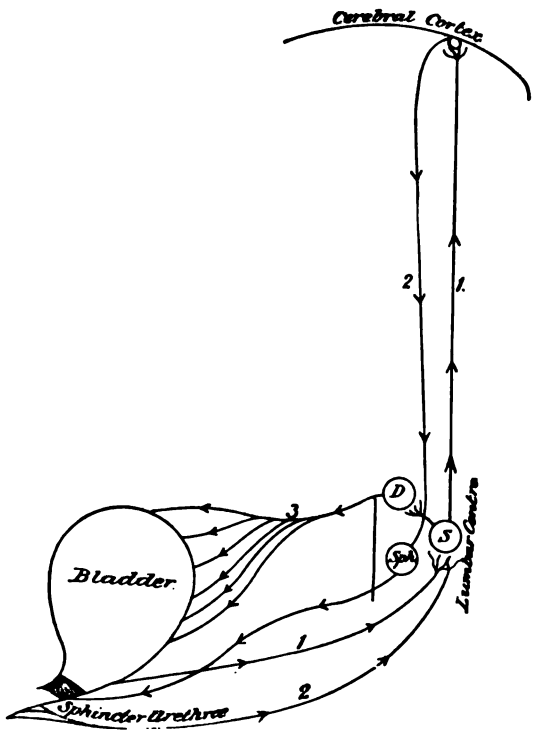


FIG. 30.—DIAGRAM SHOWING REFLEX NERVE ARC OF THE ACT OF MICTURITION.*

the sleep is abnormally long and deep, and here it is probable that the sphincter centers must be at fault. It sometimes happens that the incontinence may be produced by a reflex irritation set up by a local cause, as a vesical calculus, a cystitis, or vulvitis, or, in boys, phimosis and balanitis, an elongated or adherent foreskin, and also rectal irritation. Hyperacidity of the urine

* For a thorough description of the physiology of micturition see article by Dr. James H. McKee, "University Magazine," December, 1897.

may be a cause. In one case coming under the care of one of the authors the enuresis could be traced directly to the habitual drinking of coffee.

The **symptoms** consist in the involuntary evacuation of the bladder.

The **prognosis** depends entirely upon the cause. In a certain proportion of cases the condition will not last for a very long time, yet in many others success will not be reached except by the long-continued administration of remedies of many sorts, and a careful and thorough investigation as to the cause of the trouble. A certain proportion of cases seem to baffle all our efforts, continuing for months, sometimes with long periods of intermission, during which we are tempted to believe them cured, only to find the incontinence returning. A case of enuresis should not be considered cured until several months, or even a year, elapse without the return of the condition.

Treatment.—No matter what form of treatment is used, the results are often discouraging. Patients will temporarily improve; indeed, may seem to be cured, only to lapse again into the old condition. On the other hand, spontaneous cures are sometimes seen. Occasionally they may seem to result from nothing more than a change of surroundings or of diet. Buckingham speaks of a boy upon whom various methods of treatment had been tried who was cured during a vacation in which he cultivated a taste for athletics. There is no class of cases in which the etiology should be more carefully studied than those affected by enuresis. Central and spinal lesions and various malformations of the urinary apparatus must be sought for. The urine must be constantly examined, and if found to be highly concentrated, the patient may be greatly benefited—in some cases absolutely cured—by simply diluting it. When phimosis is a cause, it should be treated by the methods before given. Some instances of nocturnal incontinence of urine may be prevented by making the child empty the bladder thoroughly just before retiring for the night; or if the incontinence occurs during deep sleep, the child may be awakened once or twice during the night to empty the bladder. There are instances, too, where the sleep is light and shallow, and these are relieved by sulphonal at night. When the patient has a highly sensitive vesical sphincter, it may be necessary to raise the foot of the bed so as to keep the urine from pressing against that part. A regular mode of life, with outdoor exercise, is especially beneficial. In cases of lowered nerve action strychnin is indicated, while in the opposite class of cases, those with extreme irritability of the nerve centers, bromids,

atropin, and belladonna are the indicated remedies. These drugs should be given until some decided symptoms of their action are manifested. In diseases attended by congestion the use of ergot has been recommended. Cold douches to the perineum and faradism have been of some use. The passage of a cold sound in boys is recommended. Urethral electrization is often efficacious. Increasing doses of atropin or hyoscin hydrobromate are the most reliable measures.

STONE IN THE BLADDER.

In children three varieties of stone are met. The form of calculus in the bladder most frequently found is that known as the uric acid formation, which, according to statistics quoted by J. William White, composes from two-thirds to five-sixths of all calculi found in the bladders of children. This variety may be made up entirely of uric acid, or may be composite, containing also oxalate of lime and the urates of ammonium and sodium. The uric acid stone is usually not very large and of oval shape, varying in color from a yellowish white to a dark brown. Externally this form of calculus may be smooth or slightly roughened, while on section it is found to be laminated or amorphous. The laminated variety is extremely hard, and capable of a high polish. The amorphous form is easily broken, and resembles coarse sand.

The second variety is composed of oxalate of lime, and is sometimes called the mulberry calculus. It is generally round, covered with small spicules, and its color varies from gray to brownish black.

The third variety, known as the urate of ammonium calculus, is only occasionally found. It is a smooth, flat, oval stone, brittle, and of a yellowish color. Other varieties of calculus, such as the mixed phosphate or the ammoniomagnesium phosphate and those composed principally of phosphate or carbonate of lime, are occasionally seen. Cystic oxid, xanthic oxid, and other varieties of stone have been described, but are extremely rare. The size of vesical calculi varies widely. They may be single or multiple, and are described as being *free* when found loose within the bladder, and *attached* when held to the bladder-wall either by a fold of mucous membrane or a band of lymph (White).

Causes.—But little is known as to the cause of cystic calculus in children. It is possible that an inherited gouty tendency may have something to do with causation, but, on the other hand, it

has been demonstrated many times that children of the poor, or those having few of the luxuries or even the necessities of life, are more frequently affected than children born in better circumstances. Boys are more subject to stone than girls. A predisposition seems to run in certain families, and the inhabitants of some locations are more frequently affected than those of others. It might be supposed that the water-supply of a certain location could have something to do with this, yet it has been proved many times that it has not. Race seems to have some influence, it having been shown that the negro is affected far less frequently than the white races.

In almost every case stone has its origin in the kidney, and it is believed that the uric acid infarcts so often seen in the kidneys of newly born children form the first stage in the production of calculus, and that the large quantity of uric acid which is present in early life will explain the frequency of this form of calculus, or its presence may act as a nucleus of other forms of calculi which may later develop in the bladder. Occasionally the stone may be formed around a nucleus which is composed of some foreign body which has been passed into the bladder. This is, however, very rare.

Symptoms.—The group of symptoms which points to the presence of renal calculus is in most respects the same in children as in adults. In many cases the first evidence of its presence will be shown by an attack of intense pain, accompanying a group of symptoms known as nephritic colic. In the midst of health the child is suddenly attacked by violent pain, first felt in the lumbar or hypochondriacal region, and extending toward the scrotum and end of the penis. The testicle on the side affected will be drawn up by a spasm of the cremaster muscle. Pain is also felt in the groin and thigh on the affected side. The patient has a continual desire to pass water. The attack of colic is accompanied by sweating, which is profuse, and the skin becomes cold and clammy. Pain may be so intense as to cause convulsions and collapse. The urine is passed frequently, but in small amounts, and is very highly colored. Actual suppression may occur as the stone makes its progress along the ureter, and will only cease permanently when it has reached the bladder, at which time the pain also ceases suddenly. After the stone has reached the bladder, the foregoing group of symptoms give place to others.

The principal symptom of stone in the bladder is increased frequency of urination. The desire to evacuate the bladder may be continuous, amounting to actual incontinence. This symptom is

worse by day, when the patient is up and around, than at night. It is increased by motion, and its amount depends to a certain extent on the shape of the stone. Occasionally retention of urine occurs. This may be produced either by the stone acting as a ball-valve and stopping the flow of urine, or, in some rare instances, is reflex. The pain is of a darting, burning character, increased during urination, particularly at the termination. It is caused by the mucous membrane of the bladder coming in contact with the stone. The pain, however, is rarely felt in the bladder, but is referred to the under surface of the penis some distance behind the external meatus. It is often so severe as to cause convulsions. It continues until a sufficient amount of urine has collected in the bladder to raise the mucous membrane away from the stone. Various reflex pains, referred to different parts of the body, are not infrequently associated with vesical calculus; these may be felt in the rectum or perineum, and occasionally in various parts of the body far removed from the seat of the trouble. From the constant irritation of the penis the habit of masturbation may be set up, or from handling of the parts the foreskin may be rendered abnormally long, while in some cases phimosis or paraphimosis is produced by this cause. Cystitis is almost always present. From the constant efforts at straining prolapse of the rectum may be produced. When the flow of urine is stopped by the calculus obstructing the vesical orifice, the child may assume various peculiar positions while evacuating the bladder, in order to cause the stone to fall away from the opening of the urethra and allow the passage of urine. Hematuria may occur, but is rarer in children than in adults. As sequelæ we very frequently note chronic cystitis, and sometimes pyelitis. Dilatation of the ureters may occur, and from extension of inflammation there may arise nephritis or even suppurative pyelitis.

Diagnosis.—Stone in the bladder may be confounded with one of several conditions. The diseases most likely to be mistaken for it are a contraction of the urinary meatus, cystitis, phimosis, the condition known as irritable bladder, vesical tumors, and renal calculus. None of these conditions will, however, show a group of symptoms so severe and well marked as stone. The surest factor in diagnosis, however, is the finding of the stone by examination by means of a sound.

In all cases of irritability of the bladder in children, especially when there is pain during or immediately following the act of urination, and when phimosis or malformation of the penis and urethra does not exist, the bladder should be carefully examined

for stone. It is best to administer an anesthetic, in order to produce complete relaxation of the part and to prevent the child from struggling and possibly receiving injury at the time of examination. The bladder should then be filled with warm solution of boric acid, to distend the walls and give greater space for the movements of the searcher. By the careful use of a sound in the bladder the presence of a stone can readily be demonstrated by the characteristic "click" which the instrument makes in coming in contact with the stone. Sometimes this sound can be heard some distance from the patient.

The **treatment** is surgical: either by crushing (lithotrity) or lithotomy. If the stone be small, or even of moderate size, it may be crushed by a lithotrite and evacuated at one sitting—as is done in adults. Of late years this mode of operating has been very extensively practised, with admirable results. Piperazin as a solvent of uric acid stone has been largely used, with conflicting reports as to results. D. D. Stewart has reported toxic symptoms from its employment in adults, and recommends, for a child of ten years, that the dose be not over 2½ grains.

CYSTITIS.

Inflammation of the mucous membrane of the bladder is much rarer during infancy and childhood than in adult life.

Causes.—The most common cause of vesical inflammation is stone. It may also be produced by a retention of urine within the bladder, caused by a contracted meatus and from phimosis. The long-continued administration of irritating drugs may produce it, or a growth within the meatus may act as a causal factor. A form of very severe cystitis may appear in the course of tuberculosis in children, and is due to tuberculous infection of the bladder. Occasionally it is produced by an extension into the bladder of any infection from without.

Symptoms.—The symptoms of cystitis in children are practically the same as those in the adult. There is some rise of temperature and fretfulness. Indeed, the child may appear quite ill. Micturition is frequent and painful, the urine, which is passed in small quantities, is viscid, from pus and mucus, alkaline or mildly acid in reaction, and, if acid when voided, promptly undergoes decomposition, becoming strongly alkaline, converting the contained pus into a thick, mucilaginous mass—a characteristic and diagnostic sign. The microscope will show crystals of triple phosphates and amorphous phosphates of lime, pus-cells, epi-

thelium, and, in the severer cases, especially if caused by calculus, blood-corpuscles.

Chronic cystitis arises very commonly from stone in the bladder or the presence of foreign bodies—a tumor—or tuberculosis. The acute form, unmitigated by treatment, may progress into the chronic variety.

The *symptoms* are painful and frequent micturition, the passage of urine later becoming almost constant, and associated with an irritation of the external genital organs, caused by an ammoniacal condition of the urine. Prolapse of the rectum is very commonly associated, from constant straining, when the irritation is caused by the presence of a stone. The urine is subject to the same changes as in the acute form.

Prognosis.—In the acute form the prognosis is good, providing the cause can be removed. When prompt treatment is not instituted, the condition rapidly passes into the chronic form, which is very persistent and hard to control. The outlook for cure in the chronic form depends very much upon the cause and the duration of the attack. It must not be forgotten that cystitis may appear as a secondary consequence of diseases of the kidneys. The cause of the disease must always be sought for and removed if possible. The patient should be kept at rest in bed. The diet should consist of milk. Water should be given freely, and various diluent drinks, such as flaxseed tea, mucilage of acacia, and the citrate or acetate of potash, may also be made use of. The bowels should be thoroughly opened by salines. Poultices or hot fomentations should be placed over the bladder. If there is much pain, opium may be used by suppository or enema, but it must be remembered that this drug should be given with great caution to children. Various other agents may be employed, such as tincture of aconite, the spirits of nitrous ether, benzoate of sodium, etc. Tyson recommends, when great irritation is present, injections into the bladder of cocain: for an adult not more than two grains at one time. This must be used cautiously in children and in much smaller doses.

In chronic cystitis the bladder should be washed out once or even twice daily, if necessary, with warm water, to which may be added boric acid, one dram to the pint. It should be injected slowly in small quantities at a time, according to the capacity of the child's bladder, and repeated until the water comes away clear. The water should be at a temperature of about 100° F. Urotropin and cystogen are useful in older children, in doses of a grain or more three or four times daily, well diluted.

PHYSIOLOGIC ALBUMINURIA.

It is pretty generally held now that occasionally there may be an appearance of albumin in the urine that is physiologic, but before such a diagnosis is made care must be taken, first, that in performing the tests it is serum albumin that is found and not any of the other proteid bodies, such, for instance, as nucleo-albumin. This may seem at first sight a needless caution, but with some of the more recent and sensitive reagents a reaction similar to albumin is sometimes shown with even distilled water which has been passed through Swedish filter-paper, the albumin of the paper being responsible for it.

Furthermore, the albumin in these cases is always in small amount. The examinations must be continued over a considerable period of time, and the urine should show no other changes from the normal, such as casts, and the elimination of urea must show little or no diminution in quantity ; and further, to exclude the possibility of any renal changes, there should be found no such characteristic symptoms as dropsy (in any degree), a pulse of high tension, nor evidence of cardiac hypertrophy. By some it is claimed that no alteration has taken place in the epithelium lining the capillaries of the tufts or of the glomeruli, while others contend that it is always in a state of "cloudy swelling."

There occurs what is termed a "*cyclic albuminuria*," where albumin can be demonstrated during the day but is absent from the urine secreted during the night. The erect posture has been offered as an explanation. There is an occasional albuminuria that is associated with an oxaluria, and Trissier has noticed it in young children of gouty parentage, generally boys.

Among the causes said to produce it are an albuminous diet, violent exercise or emotion, and cold bathing. At times there may be no traceable cause.

Treatment.—The treatment consists in the removal of the cause, where one exists, and the building up of the patient on general lines.

DISEASES OF THE KIDNEY.

ACUTE CONGESTION OF THE KIDNEY.

Synonyms.—Renal Hyperemia; Acute Renal Catarrh.

Causes.—Acute renal congestion may occur as the result of traumatism from the use of certain irritating drugs—such as turpentine or cantharides—or from cold. The most common cause is the acute infectious diseases.

Pathology.—The blood-vessels of the kidney are engorged with blood, and, owing to this congestion, there is frequently an escape of serum, red blood-cells, and leukocytes. The epithelium of the parenchyma is in a state of "cloudy swelling."

Symptoms.—The symptoms of renal congestion itself are rather varied. There are generally some headache, pain in the back, and general malaise. The urine is scanty, highly colored, from the presence of red blood-cells or blood-casts, and of high specific gravity. It always contains some albumin. This may differ markedly in amount. The duration of the attack may vary considerably.

The **prognosis** will depend entirely upon the cause of the congestion and whether or not the congestion proves to be the beginning of an attack of acute nephritis.

Treatment.—The bowels should be freely opened, preferably by the use of salines or calomel; the latter is especially useful on account of its diuretic action. Hot vapor baths should be employed to produce diaphoresis. Mild counterirritation over the kidneys by means of dry cups or hot poultices is to be employed. When irritability of the bladder is present camphor may be used, or in some cases small doses of camphorated tincture of opium may be given with benefit.

CHRONIC CONGESTION OF THE KIDNEY.

Causes.—Chronic renal congestion may be produced by the continuance of the acute form. It is most frequently met as the result of an interference with the return circulation of the kidney, which may appear during an attack of heart disease. It is also very common in chronic bronchial pneumonia or chronic pleurisy. It may be found when this circulation is interfered with by reason of an abdominal tumor, also by thrombosis of the renal vein.

Pathology.—The kidneys are enlarged in early stage; later

they become normal in size, darker colored than normal, and of firmer consistency. The entire organ is distended with blood. The capillary vessels are engorged, their walls being thickened.

Symptoms.—General dropsy is a common feature, together with the symptoms of the disease causing it. The urine is always scanty and of high specific gravity, containing usually a small amount of albumin. The microscope will reveal the presence of a few small hyaline or granular casts. These may not, however, be regularly present. The bowels are generally constipated; irritability of the bladder is commonly present. Uremia is very infrequent.

Treatment.—In addition to the treatment of the condition causing the congestion, an effort should be made to increase the amount of urine by the use of digitalis, especially the infusion; camphorated tincture of opium, either alone or combined with sweet spirits of niter; the alkaline diuretics, caffein, and other drugs of the same order. The bowels should be kept open by salines and hot baths, or vapor baths should be used to promote diaphoresis. When the amount of urine passed is extremely small, nitroglycerin may be used with benefit. Suitable dietetic and hygienic measures should, of course, be employed.

ACUTE DEGENERATION OF THE KIDNEY.

Causes.—Acute degeneration of the kidneys is very frequently present in the course of acute infectious diseases, but it is found oftenest and is most marked in cases of diphtheria, scarlet fever, and acute pleural pneumonia. It may appear during the course of any disease accompanied by long-continued high temperature. In all probability it is caused by direct irritation of the epithelium of the tubules by toxins eliminated by the kidneys. Irritating drugs may also produce it.

Pathology.—The color of the kidney is pale, and the whole organ is somewhat enlarged. The cortex is thickened, and the straight tubules are marked by yellowish-gray lines. The epithelium of the tubules undergoes granular degeneration. Some exudation of serum may take place.

Symptoms.—There are no special symptoms connected with this form of renal disease other than those which accompany diseases producing it. The urine will contain a moderate amount of albumin and sometimes a few granular and hyaline casts.

Treatment should consist in the use of a liquid diet and diuretics, in addition to the treatment of the condition producing the degeneration.

ACUTE EXUDATIVE NEPHRITIS.

Synonyms.—Acute Parenchymatous Nephritis; Acute Septic Interstitial Nephritis; Acute Desquamative Nephritis; Acute Tubular Nephritis.

Definition.—Acute exudative nephritis is an inflammation of the true renal epithelium. In the majority of cases it is either directly or indirectly of septic origin.

Causes.—This variety of nephritis is very common among infants and children of all ages. It is most frequently seen as a secondary affection appearing in the course of, or following an attack of, the acute infectious diseases, especially scarlet fever and diphtheria. Occasionally it follows an attack of typhoid fever, measles, varicella, scurvy, meningitis, influenza, and the acute diarrheal diseases. Various irritating drugs and traumatism may occasionally produce it. It is possible that in some cases occurring in infants the septic infection causing the disease may occur through the umbilicus, as in the case reported by E. H. Root.

Pathology.—In infants and young children the predominant pathologic feature is the exudation of leukocytes. The renal epithelium and glomeruli undergo inflammatory changes. There is an exudation of blood plasma with leukocytes and red blood-cells. Enlargement of the kidney occurs, the whole organ being softened and edematous. The most marked changes occur in the cortex, which is thickened and is usually of a yellowish-white color, sometimes mottled or speckled with red, due to small hemorrhages. Occasionally the entire organ is congested. Section of the kidney will show in some cases that the inner portion, as well as the surface, may be mottled with small yellow spots, each spot being a small collection of pus. These small abscesses may vary in size from that of a pin's head to that of a pea. On microscopic examination the tubular epithelium will be swollen, loosened, and degenerated. The tubules themselves may be dilated, and may contain red and white blood-cells and degenerated epithelium. Marked changes occur in the glomeruli. The cells covering the capillary tufts, and, indeed, the capillaries themselves, undergo swelling and proliferation. The cavities of the capsules frequently contain masses of red and white blood-cells, and the smaller blood-vessels may contain bacteria. The stroma and venous capillaries contain accumulations of leukocytes, occurring usually in irregular patches. No blood serum may accompany the transudation of leukocytes, and for this reason the urine may contain no albumin. In all his postmortem examinations

Holt states that the most prominent feature in nephritis in young infants was the excessive exudation of leukocytes.

Symptoms.—Two forms of the disease are usually recognized, the primary and the secondary. In the primary form the severity of the symptoms will depend very much on the age of the patient, the disease being much more dangerous in infants and young children. In the primary form occurring in infants the symptoms are often obscure; so much so, indeed, that the origin of the disease may be misunderstood. The attack begins, in the majority of cases, abruptly, with high fever and vomiting, the temperature very often rising as high as 103° to 104° F.; in bad cases it may even reach 105° F. The type is usually irregular. Holt states that in his own cases and in those which he has collected from the experience of others diarrhea and vomiting were noticed in half the number of cases observed. Dropsy may exist to a slight degree, but is very often absent. Anemia is a prominent symptom, being present in nearly every case. This is considered a valuable diagnostic point. The nervous symptoms are usually quite prominent. These consist of restlessness, twitching of the muscles, or, in more marked cases, even convulsions. On the other hand, the mind may be dull and apathetic. True uremic coma is very seldom seen. The duration of the disease will vary from eight days to four weeks, the average being about two and a half weeks. Cases progressing to a fatal termination may develop symptoms of a true typhoid condition. The urine is slightly decreased in quantity in the majority of cases; when the attack is severe, however, the amount passed may be much smaller than normal, and, indeed, actual suppression may occasionally occur. Albumin is generally present in the early part of the attack and always during a later period. The quantity is usually not great. Microscopic examination of the urine will show the presence of hyaline, granular, and epithelial casts. Blood-casts are rare. Examination will also demonstrate the presence of pus-cells and renal epithelial cells, with some red blood-corpuscles. In older children the disease is much less severe, and the outlook for a favorable termination is better. The attack begins less abruptly and the febrile symptoms are less marked. Dropsy is slight, or, indeed, may be absent altogether. The urine is slightly diminished in quantity, and the amount of albumin much less. Casts may be present—usually the varieties before described. The general symptoms are much milder than in the form seen in infants.

The secondary form of the disease usually appears during the course of one of the infectious diseases. The constitutional

symptoms are often not marked. The urine may be somewhat diminished, and the microscopic appearances are about the same as those in the two preceding varieties.

Prognosis.—Holt states that in the twenty-three cases investigated in which the disease occurred in infants the mortality was fifteen; and in his own cases, nine in number, eight died.

Treatment.—The treatment is the same as in other forms.

ACUTE DIFFUSE NEPHRITIS.

Synonyms.—ACUTE GLOMERULONEPHRITIS; ACUTE BRIGHT'S DISEASE.

Causes.—In the majority of cases acute diffuse nephritis follows an attack of one of the infectious diseases, particularly scarlet fever, in which case it is generally admitted that the exciting cause can be attributed to the scarlatinal poison, probably the result of direct irritation from the toxins of the disease. It sometimes follows diphtheria, when the exciting cause is probably toxemic, the action of the poison being similar to the scarlatinal complication. Cold and exposure have been attributed as causes, and in some cases the etiology is obscure. As predisposing causes of the postscarlatinal variety it has been stated that allowing the patient to get up too soon after the disease or the too early administration of solid foods has a tendency to aid in the irritation of kidneys previously weakened by the scarlatinal poison. The frequency of the disease as a sequela of scarlet fever varies considerably with epidemics. Blows and injuries of the back have also been given as causes. The acute diffuse nephritis is much more frequently seen in children and young adults than in the old.

Pathology.—The main points in the morbid anatomy of the kidneys are as follows: The entire organ is enlarged, often to a considerable extent, and is softer than normal. In the early stages of the disease the kidneys are sometimes considerably congested, but after the disease is well established, they are a yellowish-white color mottled with red. Thickening of the cortex occurs, this portion being usually yellow, and showing a distinct contrast to the pyramids, which are red. Microscopic examination shows the characteristic changes of this variety of nephritis, which consist in the formation of connective-tissue cells in the stroma and proliferation of the cells forming the capsule of the Malpighian bodies. The longer the duration of the disease, the denser and more fibrous in character will the

connective tissue appear. Finally, the glomeruli undergo permanent change; the tufts will be reduced by the growth of the endothelial cells lining the capsule, which may ultimately form new fibrous tissue.

Symptoms.—The primary form of acute diffuse nephritis may begin suddenly, with fever, the temperature often rising to 101° or 102° F., and when the attack is severe it may rise much higher. There are pain in the lumbar region, headache, vomiting, and decrease in the amount of urine. Dropsy is present in the majority of cases. Occasionally the onset is slower and the symptoms less severe, the dropsy appearing slowly and the urine gradually decreasing in amount. The postscarlatinal form begins insidiously: usually in the third or fourth week of the disease. In this form moderate fever, scanty urine, and dropsy are the principal symptoms. The dropsy manifests itself in a manner which is almost characteristic; in amount it is well marked; it usually appears in the face, then in the feet, from which it ascends up the leg, and may even effect the scrotum or external labia. It may continue to progress over the whole body, generally producing anasarca. Serous effusions into the pleura or peritoneum, and more rarely into the pericardium, may occur. Anemia is very often present; always if the disease is well marked. In cases of some duration the skin assumes a peculiar waxy appearance which is one of the characteristics of the disease.

The Urine.—As a rule, this is considerably diminished in quantity; indeed, suppression is not uncommon. Albumin is always present in large amounts. The color of the urine is smoky or reddish brown, due to the presence of red blood-globules or hemoglobin. The specific gravity at first may be high, but later is generally low; the amount of urea eliminated is below normal. The microscope shows the presence of casts in great variety. Hyaline, granular, and epithelial casts are always present, and pus-, mucus-, and blood-casts are not rare. Chlorids and earthy phosphates are at first diminished. Hematin, indican, and uric acid show an increase (Tyson). Leukocytes and red blood-cells, with a large variety of cells from the renal epithelium, are present. In cases of ordinary severity which tend toward a favorable termination the symptoms should subside in from one to three weeks. The edema gradually passes away and the temperature returns to the normal. The quantity of urine increases, and the amount of urea excreted, which during the attack has been much below the average, gradually becomes greater, while the amount of albumin and the number

and variety of casts which have been present during the disease begin to decrease. It should not be forgotten that it is quite possible that a few casts and a trace of albumin may persist for a considerable time. The disease, however, may increase in severity, the temperature continue high, the pulse become full, rapid, and of high tension. The urine, which before was scanty, may now be actually suppressed and symptoms of uremia follow. The attack of uremic poisoning may begin with symptoms of restlessness or apathy, headache, nausea, and vomiting, the vomit often having the odor of urine; dimness of vision is sometimes seen. Later the patient may pass into a state of stupor or coma or have convulsions. Diarrhea is not an uncommon early symptom in children.

Complications and Sequelæ.—The most frequent complications are pneumonia, pleurisy, edema of the lung, pericarditis, or endocarditis. Occasionally, though rarely, meningitis and edema of the glottis may complicate the disease.

Prognosis.—In so far as the recovery from the acute attack is concerned the prognosis is guardedly good; the majority of patients, however, recover. There is, however, considerable danger of the disease progressing into the chronic form, in which the outlook for absolute recovery is not so favorable. The existence of severe nervous symptoms, stupor, intense headache, dimness of vision, or the appearance of uremia, would make the outlook less hopeful. The urine should be carefully examined at frequent intervals, as the amount of urea and the number and variety of the casts are valuable aids in prognosis. Of much less importance is the quantity of albumin present. Patients suffering from this disease require constant watching for a long period of time. When the case progresses into chronic nephritis, the outlook, although rather doubtful as to the chances for absolute cure, is by no means hopeless so far as the life and comfort of the patient go. With care and attention to diet and to the general rules of life, many of these patients live for many years. Relapses are frequent, and death may occur during one of these, or the patient perish from pneumonia, edema of the lungs, or from some intercurrent malady.

Treatment.—Of primary importance in the therapeutics of acute diffuse nephritis is the stimulation of the skin as the most important adjunct in eliminating the excrementitious substances of the body and thus aiding the crippled kidneys. For this purpose frequent sponging with hot water, warm baths, or, what is often better, repeated hot packs, are of the greatest use. There may also be given sweet spirits of niter, with or without very

small doses of ipecacuanha; also the fluid extract of jaborandi, in doses of from five to ten minims, repeated as often as may be necessary at intervals of from two to three hours. Poultices to the lumbar region are most efficacious. The bowels must be kept freely opened by salines and calomel. These should be given in quantities sufficient to produce two or three movements daily. The urine should be diluted as much as possible in order to decrease its irritating properties. With this in view the patient should be made to drink two or three glasses a day of filtered water, or, if it is preferable, with the addition of about twenty grains of bicarbonate of sodium to each glass. Some authorities recommend that two or three grains of the citrate of potassium be added to a glass of water. The diet should be fluid, preferably milk. Should milk not be well borne, then such preparations as whey, buttermilk, koumiss, or junket may be used. If the nephritis follows an attack of scarlet fever, it is generally recommended that the patient be kept in bed for at least a week after the temperature has become normal. In severe cases, where the fever is high, the urine scanty, and the amount of edema considerable, diaphoresis should be maintained by the use of the hot pack or vapor bath. Pilocarpin may be used hypodermically, and be given in doses of $\frac{1}{60}$ of a grain to a child of three or four years. In order to guard against the depressing effects of the drug stimulants should be conjointly given. One of the simplest and at the same time a most effective method of producing diaphoresis is to place under the bedclothing, at the feet of the patient, a very hot brick, and upon it pour about two ounces of alcohol, thus producing an alcohol vapor bath. This alone will often bring about a most profuse sweating (E. L. Duer). Counterirritation should be applied over the kidneys by poultices or a mustard plaster. In cases where symptoms of uremia occur, the temperature being high, nitroglycerin should be given in quantities sufficient to produce the effects of the drug. Holt recommends that $\frac{1}{300}$ of a grain be given every hour for three or four doses. In some cases hypodermic injections of morphin may be of service.

Venesection has also been recommended as a means of rapid depletion when the symptoms are urgent. For the anemia which is very commonly seen iron is required. When the disease has existed for some time or has passed into the subacute form, the patient had best be sent to a warm, dry climate, especially during the winter months. Flannel underclothing ought to be worn next the skin, and every precaution taken to prevent the patient taking cold.

CHRONIC NEPHRITIS.

Under the title of chronic nephritis will be described three forms of chronic inflammation of the kidney structure, both of which are rarely seen in children, yet occur with sufficient frequency to warrant at least passing notice. The varieties of chronic nephritis are, first, *chronic diffuse nephritis with exudation*, known also as *chronic parenchymatous nephritis* or the *large white kidney of Bright;* second, the so-called *waxy* or *lardaceous kidney;* third, *chronic diffuse nephritis without exudation*, known also as granular kidney, sclerosis of the kidney, contracted kidney, or chronic interstitial nephritis.

Causes.—The most frequent cause of the first variety is a continuation of the nephritis following an attack of scarlet fever or other disease of the same class; in fact, the etiology of this form of chronic renal inflammation is practically the same as that of the preceding forms described. Waxy kidney is most apt to follow prolonged suppuration, especially that accompanying disease of the bones and joints. True chronic interstitial nephritis—the variety described under the second heading—is exceedingly rare in childhood. When occurring, the causes are generally hereditary syphilis, tuberculosis, alcoholism, and chronic valvular diseases of the heart. Holt states that in nearly all cases the children suffering from this are over seven years of age.

Pathology.—*1. Chronic Diffuse Nephritis With Exudation.*—Enlargement of the kidneys occurs, the surface being smooth or slightly nodular. The enlargement may be so great that the organ attains twice the normal size, and the capsule can easily be separated from the kidney itself. The color, not only of the external but of the cut surface also, is yellowish white. Considerable tumefaction of the cortex is found on section. Microscopic examination will show the epithelium to be swollen, while degeneration of a granular or fatty character follows. The convoluted tubes are dilated and thickened, while their lumen contains broken-down granulated epithelium and cast matter. In some cases atrophy of the tubes occurs. The glomeruli will often be found compressed and atrophied from an excessive formation of new connective tissue. A fatty degeneration of the tubular epithelium is sometimes seen.

2. In the condition known as waxy degeneration there is considerable enlargement of the kidneys, the organs being grayish in color, translucent, and glistening. Their consistency is sometimes described as doughy. Amyloid deposits occur along the

renal vessels and in the vascular tufts of the glomeruli. This process may progress until the whole organ is infiltrated, the true renal structure undergoing an atrophic degeneration. The amyloid degeneration is usually associated with the same condition in other organs, especially the liver and spleen, and occasionally in the intestinal villi. The situation of the portions of the kidneys affected by the amyloid change can be demonstrated by the iodin and sulphuric acid reaction. This consists in brushing over a section of the affected kidney a solution of iodin with iodid of potassium in water. This will give a reaction of a mahogany color. If, now, diluted sulphuric acid is applied, the color of the cut surface will change to a bluish-violet tint. The anilin violet test consists in brushing over the kidney a 1 per cent. solution of anilin violet. That portion of the kidney which has undergone amyloid degeneration will show a red or pink reaction, while the unchanged tissues are stained blue.

3. Chronic Diffuse Nephritis Without Exudation.—In this form the kidneys have undergone a true sclerosis ; the whole organ is smaller than normal, the surfaces being nodular and the capsule adherent. Thinning of the cortex occurs, and the color is red or reddish gray.

The pathologic changes may be in part the same as those in the first variety, with the addition of a great increase of new connective-tissue elements. This increase is distributed in an irregular manner throughout the whole kidney structure. Dilatation of the tubules sufficient to form cysts of varying size occurs in places. At other times the tubules entirely disappear. Atrophy of the glomeruli follows unless chronic congestion has preceded the inflammation. If chronic congestion has preceded the nephritis, the glomeruli may be large and their capillaries dilated ; generally, however, they will be seen to have undergone atrophy.

Symptoms. — *1. Chronic Nephritis With Exudation.* — In many cases this form of nephritis will not be recognized until there appears a slight puffiness under the eyes or occasionally dropsy in some other part of the body. The patient will usually, on examination, be found to have had at some previous time an attack of acute renal inflammation which has never entirely subsided, but which has been unrecognized. The period of intermission since the original attack may have extended for a varying time : possibly a few months or a year or two. In some cases the symptoms of dropsy and anemia follow immediately an acute attack. As the disease progresses various digestive disturbances are noticed : there may be vomiting, not only after eating, but

also when the stomach is empty. The appetite is generally lessened. The bowels are very frequently constipated, although such patients often have short attacks of diarrhea. Anemia is always a prominent symptom. With each exacerbation of the disease various nervous symptoms appear. The patient will complain of violent attacks of headache, neuralgia, sometimes insomnia, and great loss of strength. This general group of symptoms is very common, and appears for a certain length of time, and then not infrequently disappears quite suddenly, the patient in the interval becoming quite comfortable, gaining strength to a certain degree. With each recurrence the symptoms become more marked. Finally dyspnea will develop, the heart becomes irritable, vomiting increases, apparently without cause, and the patient complains of vertigo and sometimes of defects in vision. The dropsy, which has previously been slight, may extend over the whole body. Effusions occur into the serous cavities, and the patient may die from pulmonary edema. During the exacerbations of the disease slight attacks of epistaxis not infrequently occur. During each onset the urine is scanty and highly colored, containing casts, in character granular, epithelial, and sometimes fatty or hyaline. Oil globules will often be found. The specific gravity of the urine is low, usually not over 1012 to 1015. The quantity of albumin will vary considerably; between the periods of exacerbation it may be quite small in amount. No matter how well the patient may seem to be between the attacks, some albumin and some tube-casts are almost always present. The urine will, however, be passed in much larger quantities during these intervening periods, but the specific gravity is never so high as that of normal urine.

The amount of urea excreted is below the normal. A certain amount of vesical irritation is quite commonly found. The duration of this form of nephritis differs according to the surroundings of the patient.

2. *Waxy or amyloid degeneration of the kidneys* is usually accompanied by or associated with the same sort of change in other organs, particularly the liver, spleen, and intestinal canal. Ascites is a more marked symptom in this form. The urine is generally increased in amount, is yellow in color, of low specific gravity, and will contain albumin and hyaline casts, and later waxy casts. A profuse watery diarrhea is present, and is particularly marked when the amyloid changes affect the intestinal canal, which makes the prognosis extremely grave. The peculiar whiteness of the skin, known as "alabaster cachexia," is often present.

In both the preceding forms of renal disease death most commonly occurs from acute uremia, pneumonia, pericarditis or endocarditis, or from pulmonary edema or pleurisy; rarely, however, from uremia in the amyloid variety.

3. The symptoms of chronic interstitial nephritis in children are the same as in adults. The urine is pale in color and large in quantity. The specific gravity is low, usually between 1002 and 1010. Albumin will be found in very small quantities; frequently it is not present at all for periods of varying length, as are also hyaline casts. Reduction in amount of urea is a grave symptom. Dropsy is rare at first. On the other hand, the arterial tension is generally high, and hypertrophy of the left ventricle is usually present. Atheroma of the arteries may be found even in a child as young as six years of age (Dickinson). Nervous phenomena, such as headaches, neuralgia, various disturbances of vision, and dyspnea, are very commonly seen. Death usually occurs from acute uremia, although hemorrhages, especially cerebral hemorrhages, may occur late in the disease.

The **diagnosis** of chronic nephritis in children is based practically on the same facts as similar disease occurring in adults. In cases where there are convulsions, with frequent or persistent headaches, or such conditions as anemia, cardiac hypertrophy, especially with high arterial tension, and in cases of general malnutrition, the urine should be frequently and carefully examined. When any of the group of symptoms pointing to renal disease manifest themselves, the patient should be kept under observation for a considerable period, and the case carefully studied.

Prognosis.—The outlook for complete recovery in any of these forms of nephritis is not favorable. On the other hand, much can be done in the first variety for the comfort of patients and the prolongation of their lives. There is no doubt that many cases affected with chronic nephritis, especially the exudative variety, live for years, providing they are placed amid comfortable surroundings, are kept absolutely free from worry, and in a climate of reasonably equable temperature, particularly one free from extremes of cold and heat. The prognosis in cases of waxy kidney is about the same as in the preceding form. It is possible that recovery may take place when, in cases resulting from prolonged suppuration of bone, the diseased structure has been removed. The prognosis in the interstitial variety of nephritis is always bad, although the progress of the disease is generally quite slow. The immediate prognosis will depend considerably on the amount of dropsy, the existence of valvular disease of the

heart, the amount of urea excreted, and the strength of the general excretory power of the kidneys.

Treatment.—Children affected with chronic nephritis should be placed amid surroundings free from nervous worry and strain of all kinds. It is very important that such children, as soon as the disease is recognized, be kept from school, or at least from hard study. If possible, they should be sent to a dry, warm climate, especially during the winter months. Great care should be exercised that these patients do not take cold. Woolen underclothing should be worn next to the skin at all seasons of the year. While overfatigue is extremely dangerous, yet regular exercise in the open air is of the greatest benefit. They should be dressed warmly in winter, and in summer their clothing should be so regulated as to allow them as much coolness as possible, yet avoiding any danger of chilling. The general aim of the treatment is to retard the progress of the disease as much as possible, and when symptoms arrive, to relieve them. Tonics are nearly always indicated. A good rule to remember in the administration of remedies to these patients is that during the periods of quiescence of the disease as little medicine should be given as possible. While milk is in many respects the best article of diet, yet frequently it can not be borne for a long period of time; it becomes extremely disgusting to some patients, and will finally do more harm than good. Sometimes, when milk can not be taken by itself, it can be used on desserts, on fruit, or given in some other way to make it more palatable. Much meat must not be allowed, especially where there is a tendency to a diminution in the excretion of urea, and salt meats should be prohibited. The lighter soups, fresh fish, oysters, and foods of this description may be given in moderation, as also may farinaceous foods and the starchy vegetables. The patient should be encouraged to drink water, and for this purpose many of the mineral waters are recommended, not so much for their own inherent qualities as on account of their being more palatable.

Iron should be prescribed when anemia is a prominent symptom, and when considerable dropsy exists, diuretics, saline laxatives, and calomel in small doses are needed. When the heart is weak, this condition will naturally call for cardiac stimulants. The skin should be made to do as much work as possible, thereby easing the crippled kidneys, and with this in view sponge-baths of hot water or occasional vapor baths are useful. Attacks of uremia should be treated in the usual way. If the arterial tension is high and there are convulsions or stupor, blood-letting may be resorted to. In many of these cases nitro-

glycerin will also be found useful. The hot pack and the alcohol vapor bath before alluded to are probably the best means of producing rapid diaphoresis. In cases where the uremic convulsions are marked and are accompanied by dilatation of the pupil, morphin may be administered hypodermically.

PERINEPHRITIS.

Definition.—Perinephritis consists of an inflammation of the connective tissue surrounding the kidney.

Causes.—In origin it may be primary or secondary. If primary, the cause may be from cold or exposure or traumatism. Occasionally it develops without any known cause. Secondary perinephritis may follow suppurative diseases of the kidney, a perforative appendicitis, or even caries of the vertebræ.

Pathology.—The perinephric tissues of both kidneys are affected with equal frequency, and the disease is as common in girls as in boys. It may be found at any age. When the inflammatory process progresses to the formation of an abscess, the latter usually burrows between the lumbar muscles, and may appear superficially in the posterior part of the body, near the middle of the ileocostal space. Sometimes it may proceed between the abdominal muscles and point above Poupart's ligament. Occasionally it may appear at the upper and inner aspect of the thigh, or it may rupture into the peritoneal cavity, vagina, or bladder.

Symptoms.—The symptoms of perinephritis are those of acute inflammation. The attack usually begins with a chill, fever, and pain. The pain is usually felt in the lumbar region, in the groin, along the inner side of the thigh, and in the knee, and is generally increased on moving the leg. When the disease has existed for some time, a distinct tumor, accompanied by tenderness, may be seen and felt over the region of the kidney on the affected side, and this tenderness may extend to the hip or along the back. As the inflammation proceeds there may be stiffness in the hip on the affected side. The thigh is flexed and extension will cause resistance and pain. Other movements of the limb, however, are normal. Symptoms referable to the kidneys themselves are not present in all cases. Their presence will depend, to a certain extent, on whether or not these organs share in the inflammation. Sometimes there may be some pain on micturition, and this may be increased in frequency. When pyelitis exists, the urine will contain pus. The disease may vary greatly as to the length of its duration. Acute cases may run

a course of from four to eight weeks. The disease may, however, last for several months.

Diagnosis.—The disease with which perinephritis is most likely to be confounded is *inflammation of the hip-joint.* The two affections, however, have distinct points of difference which will make the diagnosis one of not great difficulty. Perinephritis is a disease of much more intense and rapid onset, and the general symptoms are those of an acute inflammation; whereas in hip-joint disease the condition develops slowly and the constitutional symptoms may be wholly absent during the early stages of the affection. In perinephritis there is interference with flexion and extension of the thigh, but the other motions are not interfered with; whereas in hip-joint disease all movements of the joint are restricted, and there is also tenderness in the joint itself. The characteristic secondary changes in the thigh which are always present in hip-joint disease are absent in perinephritis. *Psoas abscess* may be mistaken for perinephritis, but in the former we usually have present the symptoms of tubercular disease, its characteristic temperature, and very possibly some deformity of the spine may be seen to aid in the diagnosis.

Prognosis is fairly good. The majority of cases recover from this disease.

Treatment.—This should consist in complete rest, and when the case is seen early, counterirritation should be applied over the lumbar region, or, in some cases, an ice-bag may give a better result than heat. Poultices sometimes give relief. As soon as the presence of pus can be demonstrated, an incision should be made and free drainage established.

PYELITIS.

Pyelitis is an inflammation of the mucous membrane lining the pelvis of the kidney. When a portion of the ureter or of the true kidney structure is involved, the condition is known as pyelonephritis. When an accumulation of pus exists in the pelvis of the kidney, the condition is known as pyonephrosis.

Causes.—The condition may arise from congenital malformations of the kidneys or ureters, from tuberculosis, or from new growths. It may also be caused by an extension of an inflammation of the surrounding tissues. Extension upward of a septic inflammation of the genito-urinary tract is a very common cause. It not infrequently arises from an irritation produced by a renal calculus. An acute form of the disease may follow an attack

small doses of ipecacuanha; also the fluid extract of jaborandi, in doses of from five to ten minims, repeated as often as may be necessary at intervals of from two to three hours. Poultices to the lumbar region are most efficacious. The bowels must be kept freely opened by salines and calomel. These should be given in quantities sufficient to produce two or three movements daily. The urine should be diluted as much as possible in order to decrease its irritating properties. With this in view the patient should be made to drink two or three glasses a day of filtered water, or, if it is preferable, with the addition of about twenty grains of bicarbonate of sodium to each glass. Some authorities recommend that two or three grains of the citrate of potassium be added to a glass of water. The diet should be fluid, preferably milk. Should milk not be well borne, then such preparations as whey, buttermilk, koumiss, or junket may be used. If the nephritis follows an attack of scarlet fever, it is generally recommended that the patient be kept in bed for at least a week after the temperature has become normal. In severe cases, where the fever is high, the urine scanty, and the amount of edema considerable, diaphoresis should be maintained by the use of the hot pack or vapor bath. Pilocarpin may be used hypodermically, and be given in doses of $\frac{1}{60}$ of a grain to a child of three or four years. In order to guard against the depressing effects of the drug stimulants should be conjointly given. One of the simplest and at the same time a most effective method of producing diaphoresis is to place under the bedclothing, at the feet of the patient, a very hot brick, and upon it pour about two ounces of alcohol, thus producing an alcohol vapor bath. This alone will often bring about a most profuse sweating (E. L. Duer). Counterirritation should be applied over the kidneys by poultices or a mustard plaster. In cases where symptoms of uremia occur, the temperature being high, nitroglycerin should be given in quantities sufficient to produce the effects of the drug. Holt recommends that $\frac{1}{300}$ of a grain be given every hour for three or four doses. In some cases hypodermic injections of morphin may be of service.

Venesection has also been recommended as a means of rapid depletion when the symptoms are urgent. For the anemia which is very commonly seen iron is required. When the disease has existed for some time or has passed into the subacute form, the patient had best be sent to a warm, dry climate, especially during the winter months. Flannel underclothing ought to be worn next the skin, and every precaution taken to prevent the patient taking cold.

CHRONIC NEPHRITIS.

Under the title of chronic nephritis will be described three forms of chronic inflammation of the kidney structure, both of which are rarely seen in children, yet occur with sufficient frequency to warrant at least passing notice. The varieties of chronic nephritis are, first, *chronic diffuse nephritis with exudation*, known also as *chronic parenchymatous nephritis* or the *large white kidney of Bright;* second, the so-called *waxy* or *lardaceous kidney;* third, *chronic diffuse nephritis without exudation*, known also as granular kidney, sclerosis of the kidney, contracted kidney, or chronic interstitial nephritis.

Causes.—The most frequent cause of the first variety is a continuation of the nephritis following an attack of scarlet fever or other disease of the same class; in fact, the etiology of this form of chronic renal inflammation is practically the same as that of the preceding forms described. Waxy kidney is most apt to follow prolonged suppuration, especially that accompanying disease of the bones and joints. True chronic interstitial nephritis—the variety described under the second heading—is exceedingly rare in childhood. When occurring, the causes are generally hereditary syphilis, tuberculosis, alcoholism, and chronic valvular diseases of the heart. Holt states that in nearly all cases the children suffering from this are over seven years of age.

Pathology.—*1. Chronic Diffuse Nephritis With Exudation.*—Enlargement of the kidneys occurs, the surface being smooth or slightly nodular. The enlargement may be so great that the organ attains twice the normal size, and the capsule can easily be separated from the kidney itself. The color, not only of the external but of the cut surface also, is yellowish white. Considerable tumefaction of the cortex is found on section. Microscopic examination will show the epithelium to be swollen, while degeneration of a granular or fatty character follows. The convoluted tubes are dilated and thickened, while their lumen contains broken-down granulated epithelium and cast matter. In some cases atrophy of the tubes occurs. The glomeruli will often be found compressed and atrophied from an excessive formation of new connective tissue. A fatty degeneration of the tubular epithelium is sometimes seen.

2. In the condition known as waxy degeneration there is considerable enlargement of the kidneys, the organs being grayish in color, translucent, and glistening. Their consistency is sometimes described as doughy. Amyloid deposits occur along the

renal vessels and in the vascular tufts of the glomeruli. This process may progress until the whole organ is infiltrated, the true renal structure undergoing an atrophic degeneration. The amyloid degeneration is usually associated with the same condition in other organs, especially the liver and spleen, and occasionally in the intestinal villi. The situation of the portions of the kidneys affected by the amyloid change can be demonstrated by the iodin and sulphuric acid reaction. This consists in brushing over a section of the affected kidney a solution of iodin with iodid of potassium in water. This will give a reaction of a mahogany color. If, now, diluted sulphuric acid is applied, the color of the cut surface will change to a bluish-violet tint. The anilin violet test consists in brushing over the kidney a 1 per cent. solution of anilin violet. That portion of the kidney which has undergone amyloid degeneration will show a red or pink reaction, while the unchanged tissues are stained blue.

3. Chronic Diffuse Nephritis Without Exudation.—In this form the kidneys have undergone a true sclerosis ; the whole organ is smaller than normal, the surfaces being nodular and the capsule adherent. Thinning of the cortex occurs, and the color is red or reddish gray.

The pathologic changes may be in part the same as those in the first variety, with the addition of a great increase of new connective-tissue elements. This increase is distributed in an irregular manner throughout the whole kidney structure. Dilatation of the tubules sufficient to form cysts of varying size occurs in places. At other times the tubules entirely disappear. Atrophy of the glomeruli follows unless chronic congestion has preceded the inflammation. If chronic congestion has preceded the nephritis, the glomeruli may be large and their capillaries dilated ; generally, however, they will be seen to have undergone atrophy.

Symptoms. — *1. Chronic Nephritis With Exudation.* — In many cases this form of nephritis will not be recognized until there appears a slight puffiness under the eyes or occasionally dropsy in some other part of the body. The patient will usually, on examination, be found to have had at some previous time an attack of acute renal inflammation which has never entirely subsided, but which has been unrecognized. The period of intermission since the original attack may have extended for a varying time : possibly a few months or a year or two. In some cases the symptoms of dropsy and anemia follow immediately an acute attack. As the disease progresses various digestive disturbances are noticed : there may be vomiting, not only after eating, but

also when the stomach is empty. The appetite is generally lessened. The bowels are very frequently constipated, although such patients often have short attacks of diarrhea. Anemia is always a prominent symptom. With each exacerbation of the disease various nervous symptoms appear. The patient will complain of violent attacks of headache, neuralgia, sometimes insomnia, and great loss of strength. This general group of symptoms is very common, and appears for a certain length of time, and then not infrequently disappears quite suddenly, the patient in the interval becoming quite comfortable, gaining strength to a certain degree. With each recurrence the symptoms become more marked. Finally dyspnea will develop, the heart becomes irritable, vomiting increases, apparently without cause, and the patient complains of vertigo and sometimes of defects in vision. The dropsy, which has previously been slight, may extend over the whole body. Effusions occur into the serous cavities, and the patient may die from pulmonary edema. During the exacerbations of the disease slight attacks of epistaxis not infrequently occur. During each onset the urine is scanty and highly colored, containing casts, in character granular, epithelial, and sometimes fatty or hyaline. Oil globules will often be found. The specific gravity of the urine is low, usually not over 1012 to 1015. The quantity of albumin will vary considerably; between the periods of exacerbation it may be quite small in amount. No matter how well the patient may seem to be between the attacks, some albumin and some tube-casts are almost always present. The urine will, however, be passed in much larger quantities during these intervening periods, but the specific gravity is never so high as that of normal urine.

The amount of urea excreted is below the normal. A certain amount of vesical irritation is quite commonly found. The duration of this form of nephritis differs according to the surroundings of the patient.

2. *Waxy or amyloid degeneration of the kidneys* is usually accompanied by or associated with the same sort of change in other organs, particularly the liver, spleen, and intestinal canal. Ascites is a more marked symptom in this form. The urine is generally increased in amount, is yellow in color, of low specific gravity, and will contain albumin and hyaline casts, and later waxy casts. A profuse watery diarrhea is present, and is particularly marked when the amyloid changes affect the intestinal canal, which makes the prognosis extremely grave. The peculiar whiteness of the skin, known as "alabaster cachexia," is often present.

[illegible]

Prognosis. The outlook for complete recovery in any of the forms of nephritis is not favorable. On the other hand, much can be done in the first variety for the comfort of patients and the prolongation of their lives. There is no doubt that many cases affected with chronic nephritis, especially the exudative variety, live for years, providing they are placed amid comfortable surroundings, are kept absolutely free from worry, and in a climate of reasonably equable temperature, particularly one free from extremes of cold and heat. The prognosis in cases of waxy kidney is about the same as in the preceding form. It is possible that recovery may take place when, in cases resulting from prolonged suppuration of bone, the diseased structure has been removed. The prognosis in the interstitial variety of nephritis is always bad, although the progress of the disease is generally quite slow. The immediate prognosis will depend considerably on the amount of dropsy, the existence of valvular disease of the

heart, the amount of urea excreted, and the strength of the general excretory power of the kidneys.

Treatment.—Children affected with chronic nephritis should be placed amid surroundings free from nervous worry and strain of all kinds. It is very important that such children, as soon as the disease is recognized, be kept from school, or at least from hard study. If possible, they should be sent to a dry, warm climate, especially during the winter months. Great care should be exercised that these patients do not take cold. Woolen underclothing should be worn next to the skin at all seasons of the year. While overfatigue is extremely dangerous, yet regular exercise in the open air is of the greatest benefit. They should be dressed warmly in winter, and in summer their clothing should be so regulated as to allow them as much coolness as possible, yet avoiding any danger of chilling. The general aim of the treatment is to retard the progress of the disease as much as possible, and when symptoms arrive, to relieve them. Tonics are nearly always indicated. A good rule to remember in the administration of remedies to these patients is that during the periods of quiescence of the disease as little medicine should be given as possible. While milk is in many respects the best article of diet, yet frequently it can not be borne for a long period of time; it becomes extremely disgusting to some patients, and will finally do more harm than good. Sometimes, when milk can not be taken by itself, it can be used on desserts, on fruit, or given in some other way to make it more palatable. Much meat must not be allowed, especially where there is a tendency to a diminution in the excretion of urea, and salt meats should be prohibited. The lighter soups, fresh fish, oysters, and foods of this description may be given in moderation, as also may farinaceous foods and the starchy vegetables. The patient should be encouraged to drink water, and for this purpose many of the mineral waters are recommended, not so much for their own inherent qualities as on account of their being more palatable.

Iron should be prescribed when anemia is a prominent symptom, and when considerable dropsy exists, diuretics, saline laxatives, and calomel in small doses are needed. When the heart is weak, this condition will naturally call for cardiac stimulants. The skin should be made to do as much work as possible, thereby easing the crippled kidneys, and with this in view sponge-baths of hot water or occasional vapor baths are useful. Attacks of uremia should be treated in the usual way. If the arterial tension is high and there are convulsions or stupor, blood-letting may be resorted to. In many of these cases nitro-

glycerin will also be found useful. The hot pack and the alcohol vapor bath before alluded to are probably the best means of producing rapid diaphoresis. In cases where the uremic convulsions are marked and are accompanied by dilatation of the pupil, morphin may be administered hypodermically.

PERINEPHRITIS.

Definition.—Perinephritis consists of an inflammation of the connective tissue surrounding the kidney.

Causes.—In origin it may be primary or secondary. If primary, the cause may be from cold or exposure or traumatism. Occasionally it develops without any known cause. Secondary perinephritis may follow suppurative diseases of the kidney, a perforative appendicitis, or even caries of the vertebræ.

Pathology.—The perinephric tissues of both kidneys are affected with equal frequency, and the disease is as common in girls as in boys. It may be found at any age. When the inflammatory process progresses to the formation of an abscess, the latter usually burrows between the lumbar muscles, and may appear superficially in the posterior part of the body, near the middle of the ileocostal space. Sometimes it may proceed between the abdominal muscles and point above Poupart's ligament. Occasionally it may appear at the upper and inner aspect of the thigh, or it may rupture into the peritoneal cavity, vagina, or bladder.

Symptoms.—The symptoms of perinephritis are those of acute inflammation. The attack usually begins with a chill, fever, and pain. The pain is usually felt in the lumbar region, in the groin, along the inner side of the thigh, and in the knee, and is generally increased on moving the leg. When the disease has existed for some time, a distinct tumor, accompanied by tenderness, may be seen and felt over the region of the kidney on the affected side, and this tenderness may extend to the hip or along the back. As the inflammation proceeds there may be stiffness in the hip on the affected side. The thigh is flexed and extension will cause resistance and pain. Other movements of the limb, however, are normal. Symptoms referable to the kidneys themselves are not present in all cases. Their presence will depend, to a certain extent, on whether or not these organs share in the inflammation. Sometimes there may be some pain on micturition, and this may be increased in frequency. When pyelitis exists, the urine will contain pus. The disease may vary greatly as to the length of its duration. Acute cases may run

a course of from four to eight weeks. The disease may, however, last for several months.

Diagnosis.—The disease with which perinephritis is most likely to be confounded is *inflammation of the hip-joint.* The two affections, however, have distinct points of difference which will make the diagnosis one of not great difficulty. Perinephritis is a disease of much more intense and rapid onset, and the general symptoms are those of an acute inflammation; whereas in hip-joint disease the condition develops slowly and the constitutional symptoms may be wholly absent during the early stages of the affection. In perinephritis there is interference with flexion and extension of the thigh, but the other motions are not interfered with; whereas in hip-joint disease all movements of the joint are restricted, and there is also tenderness in the joint itself. The characteristic secondary changes in the thigh which are always present in hip-joint disease are absent in perinephritis. *Psoas abscess* may be mistaken for perinephritis, but in the former we usually have present the symptoms of tubercular disease, its characteristic temperature, and very possibly some deformity of the spine may be seen to aid in the diagnosis.

Prognosis is fairly good. The majority of cases recover from this disease.

Treatment.—This should consist in complete rest, and when the case is seen early, counterirritation should be applied over the lumbar region, or, in some cases, an ice-bag may give a better result than heat. Poultices sometimes give relief. As soon as the presence of pus can be demonstrated, an incision should be made and free drainage established.

PYELITIS.

Pyelitis is an inflammation of the mucous membrane lining the pelvis of the kidney. When a portion of the ureter or of the true kidney structure is involved, the condition is known as pyelonephritis. When an accumulation of pus exists in the pelvis of the kidney, the condition is known as pyonephrosis.

Causes.—The condition may arise from congenital malformations of the kidneys or ureters, from tuberculosis, or from new growths. It may also be caused by an extension of an inflammation of the surrounding tissues. Extension upward of a septic inflammation of the genito-urinary tract is a very common cause. It not infrequently arises from an irritation produced by a renal calculus. An acute form of the disease may follow an attack

of the infectious fevers or of septicemia. Not infrequently nephritis is coexistent.

Pathology.—Pyelitis may affect one or both kidneys. In the acute form the mucous membrane presents the usual appearance of acute catarrhal inflammation; it is congested, swollen, and, in the severer cases, with formation of pus, small hemorrhages will be found. When the disease becomes chronic, the mucous membrane is thickened and granular.

Symptoms.—The symptoms will, to a certain extent, depend upon the cause. When the attack is acute and is produced by a stone or other cause of direct renal irritation, there may be chills, pain, fever, and attacks of renal colic. When the cause is tuberculosis or abscess in the kidney, there will be recurring chills, fever, sweats, and some pain. The patient will suffer progressive loss of flesh, and present the general appearance of deteriorated health. The quantity of urine is usually somewhat diminished. Its reaction is acid; albumin, pus, and epithelial and blood-cells are found in it. Hyaline and granular epithelial casts and bacteria are also generally present.

The **diagnosis** can be made from the symptoms and from examination of the urine. In differentiating this condition from cystitis it should be remembered that the urine is less apt to be acid in reaction in inflammation of the bladder, and in the latter condition the quantity of pus will be much less. The presence of tube-casts and of renal epithelial cells, as well as the more severe general symptoms, will generally be sufficient to prove the diagnosis.

Treatment.—The patient should be placed on a fluid diet, and when the urine is irritating, by reason of its high degree of acidity, the latter should be neutralized by the administration of citrate of potassium or by free administration of a simple alkaline water. Counterirritation over the lumbar region by the use of dry cups, poultices, or mustard plasters should be employed. When pyonephrosis exists, the question of surgical interference must be considered. If only one kidney is affected, its removal promises a chance of recovery; but usually both organs are involved.

RENAL CALCULI.

Renal calculi may be formed at any period of life. The stones may vary in size very considerably. They are usually found in the pelvis and calices of the kidney and are composed of uric acid. When very small, they may be seen as small granular deposits in the pelvis of the kidney.

Symptoms.—When the deposits are small, they may be excreted through the pelvis of the kidney and ureter without producing any symptoms. When large, however, their passage generally causes the condition known as renal colic. The patient is suddenly seized with intense pain and tenderness over the affected kidney. The pain soon radiates around the affected side diagonally across the abdomen to the region of the bladder. There may be pain in the perineum, and in boys the testicle on the affected side is retracted. Sometimes the pain may even radiate to the opposite side of the body. The attack will continue at intervals until the stone has reached the bladder, when it usually ceases suddenly. During the attack, and for a short time afterward, the urine may contain traces of blood and some albumin. When pyelitis has been produced by the irritation of the stone, the symptoms of this condition will be present, and the urine will contain pus and epithelial cells from the pelvis of the kidney. In some cases the pain is so great as to produce collapse. When the stone becomes impacted in the upper part of the ureter, hydronephrosis or pyonephrosis occurs.

The **treatment** of renal calculi in children is the same as in the adult.

TUBERCULOSIS OF THE KIDNEY.

Tubercular affection of the kidney usually occurs as a secondary complication of general tubercular disease. The source of infection is often in the blood, and very rarely the extension of tubercular disease from the bladder. It is stated that the disease generally begins in the pelvis and calices of the kidney. Later the pyramids and cortex become involved. As a rule, only one of the kidneys is affected. Not infrequently a tubercular perinephric abscess will coexist.

Symptoms.—These, in many cases, are obscure. Pain or tenderness in the region of the kidney and possibly some swelling are common features; the latter is particularly the case if perinephritis exists. Irritability of the bladder is generally present. The urine is decreased in amount and contains pus. A sure point of diagnosis would be the recognition of the tubercle bacillus in the urine. Renal tuberculosis is most commonly seen in children between two and twelve years of age, although it may be found at any period of life.

The **treatment** is purely surgical, and consists in removing the kidney.

TUMORS OF THE KIDNEY.

Tumors of the kidney in childhood may be benign or malignant. The former are very rare. Aldibert has reported three cases: one each of adenoma, fibroma, and fibrocystic tumor. These tumors can be recognized by their slow growth and by their mild constitutional symptoms. The commonest forms of malignant tumors of the kidney occurring in children are sarcoma and carcinoma, the former being most frequently seen. They are usually primary growths, and rarely occur in children under five years of age. After this time, however, they are by no means a rare form of abdominal neoplasm.

Pathology.—The type of sarcoma is usually round- or spindle-celled, but myosarcoma is sometimes seen. They may grow from the cortex or the pelvis of the kidney, and sometimes from the adrenals. Infiltration of the whole organ may take place even to such an extent as to destroy the entire renal structure. Metastasis may occur in the opposite kidney, lungs, or other neighboring structures. Hydronephrosis, due to pressure upon the ureter, or serious complications, such as thrombosis, from pressure upon the vena cava, may take place. As the tumor grows it becomes adherent to the surrounding organs. Ascites and general peritonitis may appear in the later stages. In size the tumor may reach very considerable proportions. According to Holt, the weight may be as high as fifteen pounds, and he states that one case has been reported by Jacobi in which the tumor weighed thirty-six pounds. The right kidney is rather more frequently involved than the left.

Symptoms.—The principal symptoms are a rapidly growing tumor, with progressive emaciation and cachexia. Pain may be present, but not infrequently it is slight or may be entirely absent. The tumor may at times be made out over the region of the kidney, but oftener, as it grows in the direction of least resistance, is felt underlying the large bowel. The increase in size is rapid. The urine may at intervals contain blood, pus, or albumin. Sometimes this does not occur until late in the disease.

The **prognosis** is unfavorable.

The **treatment** should be by operative means.

The uric acid conditions (lithuria, lithemia) are considered in the chapter on Constitutional Diseases, page 389.

CHAPTER IX.

DISEASES OF THE GENITAL ORGANS.

ADHERENT PREPUCE AND PHIMOSIS.

Adhesions between the prepuce and the glans penis are not infrequent at birth. They may appear in congenital forms or may be acquired. If the latter, they are usually caused by an irritation set up by the collection of smegma accumulating under a long, tight foreskin. Phimosis is that condition by which the foreskin is prevented from being drawn back over the glans by an abnormal smallness of the opening of the prepuce. Both adherent prepuce and phimosis of a not marked degree are seen in a large number of children, and both conditions frequently disappear shortly after birth. They may, however, give rise to quite a variety of very distressing **symptoms** and **sequelæ.** Thus we may have great pain on urination, which will cause the infant to cry vehemently, and in many of these cases it will be seen that the foreskin will balloon during the act of urination, showing that the prepuce is adherent to the glans, the stream of urine being very small, or in some cases simply dropping away. A certain amount of urine is generally retained and will increase the irritation—in fact, may set up an actual balanitis or even a cystitis. Various nervous phenomena may accompany the condition. In infants as well as older children the symptoms may be very varied. Choreic movements, incontinence of urine, convulsions, and persistent spasm of certain sets of muscles may be produced, and a chronic state of malnutrition often follows this condition. There may be even a prolapse of the rectum, or hernia from constant straining in voiding the urine. Adherent prepuce and phimosis are undoubtedly among the most common causes of masturbation in young boys.

The **treatment** should consist in breaking up the adhesions by passing the end of a blunt probe between the mucous membrane and the glans and dilating the preputial orifice with the blades of a pair of surgical dressing forceps. After this is done the prepuce should be drawn back so as to expose the glans,

which should then be cleansed and anointed with vaselin or any bland antiseptic ointment, after which the prepuce should be brought forward again. This should be done gently and repeated every day until danger of readhesion be passed. It is our experience—and we habitually give attention to the condition of the foreskin in all male babies—that the careful and prompt operation of stripping is in the majority of cases sufficient. The need for the operation of circumcision is much exaggerated. It should be borne in mind that where the foreskin is kept back too long there is some danger of producing the condition known as paraphimosis. Where dilatation does not produce relief after several repetitions, the foreskin may be slit up as far as the corona glandis, along the dorsum, and the edges trimmed off with a pair of scissors. The mucous membrane may be stitched to the skin with fine silk or fine catgut. If this does not give relief, the regular operation of circumcision should be performed.

PARAPHIMOSIS.

Paraphimosis is a condition in which the prepuce has been drawn back over the corona glandis, and by reason of an abnormally small preputial orifice or an increased size of the glans, can not be returned to its proper position. Following the retraction of the prepuce there are usually swelling of the glans and considerable edema. It may occur from a variety of causes. It may be congenital, although this form is rare.

The **treatment** consists in endeavoring to reduce the paraphimosis as quickly as possible by pressing the glans with the thumb and finger of one hand, while with the other hand an effort is made to draw the foreskin forward over the corona. Where this fails, it may be necessary in some cases to make a series of small punctures of the edematous mucous membrane, after which the same manipulation should be repeated. If the second method is not successful, the end of a blunt-pointed bistoury should be introduced under the edge of the prepuce which forms the constricting ring, and severing it on the dorsum of the glans. It may be necessary to divide the ring at more than one point. The local injection of cocain, the part having been previously anesthetized with chlorid of ethyl or ice and salt, is often all that is necessary, but occasionally etherization of the patient will be required before operating. Circumcision should not be resorted to unless necessary.

BALANITIS.

This condition is occasionally met with in children, and is frequently the result of neglected phimosis. Very considerable swelling of the prepuce occurs, accompanied by discharge, often of large quantities of pus, producing great pain and scalding on micturition.

The **treatment** should consist in syringing the cavity beneath the prepuce with a warm, bland antiseptic solution. After relief of the phimosis, application of lead-water will often reduce the inflammation.

VULVOVAGINITIS.

Vulvovaginitis in children is usually found in two forms, the catarrhal and the gonorrheal. The catarrhal form arises from irritation, which is produced by a variety of causes. In very young children it may be brought about by the continued use of diapers soiled with discharges or from general lack of cleanliness. Seat-worms are a very common cause. It may also be due to traumatism and attempts at rape, or, in rare cases, a true gonorrheal infection. A form of vulvovaginitis known as the aphthous variety is found in generally ill-nourished and unhealthy children, or may occur as a sequela of one of the continued fevers or any constitutional disease, as nephritis, tuberculosis, etc.

In girls at the age of puberty it sometimes arises from retention of the menstrual secretion by an imperforate hymen.

The **symptoms** are those found in other forms of catarrhal inflammation. There are, generally, discomfort, some swelling of the parts, a burning pain on micturition, and a local rise of temperature. The secretion is at first arrested, the parts becoming dry, but later it is considerably increased, often with formation of pus. The patient complains, as a rule, of continual smarting and burning. There may be, in the early stages, some general rise of temperature.

In the *gonorrheal form* the symptoms are the same as in the previous variety, except that they are apt to be more intense. The discharge is free, and consists of thick, greenish-yellow pus, in which gonococci can be found. The parts are excoriated, and generally very painful. Some swelling of the inguinal glands may occur. It is by no means uncommon in children, as in adults, to find the urethra involved in the general irritation. A positive differential diagnosis, however, can not always be made without the aid of the microscope and culture tube.

The **prognosis** in both forms of vulvovaginitis is good. How-

ever, it must be borne in mind that in the gonorrheal form the infection may spread into the urethra and bladder, producing inflammation of these parts.

The **treatment** consists of absolute cleanliness. The parts should be bathed in warm water and Castile soap, after which they may be dusted with a powder consisting of calomel and starch, bismuth and starch, or boric powder. Ichthyol, in the proportion of 5 parts to 100 of glycerin, may be applied on a tampon, or pledgets of cotton saturated in lead-water and laudanum may be used. Where the irritation is caused by worms, rectal injections of an infusion of quassia in the strength of one to two ounces to a pint of water may be used with benefit. The aphthous form should be treated not only by local applications, but also by attention to the general health, efforts being made to build the patient up, so far as possible, by tonics and nutritious food.

Gonorrheal vulvovaginitis is best treated by local applications of corrosive sublimate, 1 : 5000; boric acid, one dram to one pint; creolin, 1 : 500, or, in some cases, a 2 per cent. solution of nitrate of silver. These should be applied by means of pledgets of cotton placed between the labia, or may be injected in the vagina by means of a small rubber catheter attached to a fountain syringe. Before applying any of the above, it is generally well to wash the parts thoroughly with warm water and Castile soap, after which they should be carefully dried by means of pieces of absorbent cotton. The parts may be dusted with a powder consisting of bismuth and starch or pulverized oxid of zinc and boric acid.

ORCHITIS.

Inflammation of the testis is seldom seen in childhood, except as the result of traumatism. It may rarely follow an attack of mumps, but in childhood this is much less frequent than in the adult. Not infrequently orchitis is accompanied by hydrocele.

The **treatment** should consist in supporting the testicle by means of a suitable bandage or pads of cotton and the local application of lead-water and laudanum. Laxatives should be used to keep the bowels freely opened.

TUBERCULAR DISEASE OF THE TESTICLE.

Tubercular disease of the testicle is rarer in infancy and childhood than in adult life. When present, the testicle will be found considerably swollen, nodular, and not very tender. As the dis-

ease progresses adhesions may form between the testicle and the scrotum. The glands may break down late in the disease and suppuration occur. Tubercular disease of the testicle is found in two forms: (1) As secondary to a general tubercular infection or (2) as a part of a localized tuberculosis of the genito-urinary tract.

Treatment.—Where the diseased condition of the testicles is a part of a general tuberculosis, the orchitis should be treated symptomatically and attention paid to the general tubercular infection, the treatment of which is considered in the chapter on Tuberculosis. In all cases of tubercular disease of the testes castration should be performed; especially should this be done to young children. There is always a danger of general systemic infection resulting from the diseased testicle.

EPIDIDYMITIS.

Inflammation of the epididymis may be caused by traumatism or by continuation of irritation of the urethral mucous membrane. The epididymis will be found considerably enlarged and very tender, and by its swelling it will push the testicle forward. The spermatic cord is often inflamed, enlarged, and extremely painful on pressure. It is not uncommon to find the whole scrotum swollen and very painful.

The **treatment** should consist of absolute rest, the patient lying on his back. The bowels should be kept open. Local applications in the form of hot poultices or lead-water and laudanum should be made to the scrotum. The scrotum should always be supported in this as in all forms of inflammation of this region. Rotch recommends that the testicle be always placed in such a position that the lower end of the gland points upward.

HYDROCELE.

This condition is not at all uncommon in children, being quite frequently met with in the early years of life, and may be acute or chronic. It may result from a variety of causes, sometimes arising from traumatism, as by pressure, and sometimes during or after attacks of influenza, typhoid fever, scarlatina, or mumps. It may in some instances result from simple irritation. Occasionally it is congenital. The form known as infantile hydrocele is really a condition where the tunica vaginalis and funicular process are distended with fluid, the processes being closed at the

internal abdominal ring. The funicular part of the process may remain open and be shut off from the tunica vaginalis.

In the third variety there may be an encysted hydrocele of the cord, due to distention of an unclosed segment of the funicular process.

Diagnosis.—The condition with which it is most likely to be confused is scrotal hernia, the diagnosis of which has been given under the head of Hernia.

Treatment.—In acute hydrocele rest and the local application of cold, ichthyol, or lead-water cloths are employed, or treatment by puncture if the above be unsuccessful. Chronic cases should be treated by a truss in the same manner as hernia, an effort being made to close the neck of the canal.

In all forms of irreducible hydrocele the treatment is by evacuation of the fluid by means of a small trocar and cannula under antiseptic precautions. If this is unsuccessful, it is advisable that the sac be extirpated or a weak solution of iodin be injected. When a cure is not effected by means of simple evacuation, the sac should be laid open, the cavity packed with iodoform gauze, the strictest antiseptic precautions being followed, and the wound allowed to heal by granulation. If the sac be large, a small portion of its walls on each side of the incision should be cut away. This is a perfectly safe and rapid method of radical cure of this condition. Many cases of the infantile variety get well without treatment.

Hydrocele in Female Children.—Although hydrocele is much rarer in female than in male children, yet it sometimes occurs. It consists in a collection of fluid in the tube-like pouch of the peritoneum, which accompanies the round ligament through the inguinal canal and is known by the name of the canal of Nuck. Occasionally the exudation of fluid may take place in the tissues of the round ligament itself or in the labium majora, external to the covering of the round ligament.

The **symptoms** will be the appearance of a tumor in the labia or in the inguinal region. Fluctuation will be obtained in this tumor. It will also be translucent. Appearing in girls at the age of puberty, it might possibly be confounded with a cyst or abscess of the vulvovaginal gland, but the lack of inflammatory symptoms and the fact that cysts are found in the upper and outer part of the labii majoræ would aid in the diagnosis. Pudendal hernia would be excluded by the fact that in hydrocele there is no impulse on coughing and the other symptoms of hernia are absent.

The **treatment** is the same as that of hydrocele in male children.

VARICOCELE is a very rare affection in childhood. Ashby and Wright claim they have never seen it earlier than the tenth year.

Treatment will be the same as that for the same affection in adults.

OVARIAN TUMORS in children are exceedingly rare. When found, they are usually dermoid cysts, carcinomata, or teratomata.

The **treatment** of these would be the same as in the adult.

UNDESCENDED TESTICLE.

Ordinarily the testes descend into the scrotum during the eighth month of intra-uterine life, but occasionally children are born with the glands still within the abdominal ring. In cases where some years have elapsed without the descent of the testicles it is quite possible that atrophy may take place, although this is by no means necessary. It sometimes happens that one or both of the testicles will descend and return to the abdominal cavity again.

Treatment.—The location of the gland is most important in determining the treatment. In cases where the testicle shows a tendency to descend it should be allowed to do so, as this may take place even after a lapse of several years.

The majority of cases, however, will require surgical interference. For the details of such operation the reader is referred to surgical works upon the subject.

TORSION OF THE SPERMATIC CORD.

Occasionally one of the testes is twisted upon the cord sufficiently to cause constriction of the circulation, and even gangrene. This generally happens in an undescended or partially descended testicle.

It is very difficult to differentiate between this condition and a strangulated hernia.

Operation is necessary: the cord untwisted if possible, or, if there be any doubt as to the vitality of the tissues, the testicle and cord must be excised.

HYPOSPADIAS.

The condition known as hypospadias is the result of arrested development in the urethra and corpus spongiosum. Normally, the urethral groove should, by the uniting of its sides, be con-

verted into a canal. This process of union begins at the base and extends to the end of the penis, and arrest of this process of development may cause the urethra to open at any point along the inferior margin of the penis. In female children the urethra usually opens directly into the vestibule.

EPISPADIAS.

In males this variety of malformation is produced by the urethral canal opening upon the dorsum of the penis. It is very commonly associated with extroversion of the bladder. Occasionally there is a defect in the union of the anterior abdominal wall and a cleft in the symphysis pubis. In female children the anterior wall of the urethra is absent. The nymphæ and clitoris are generally split.

The **treatment** should be by surgical means.

CHAPTER X.

DISEASES OF THE BLOOD.

GENERAL CONSIDERATIONS AND DEFINITIONS.

The essential features for consideration in a study of the blood are its coagulability and the red and white corpuscles. Our knowledge of the so-called blood plaques or plates is as yet too limited to warrant more than a reference to their existence in this chapter.

In health a uniform and recognized ratio is always maintained between the number of the red and white cells, although slight discrepancies occur in all counts made of the same specimen by different observers. For all practical purposes the normal number of red cells is estimated at 5,000,000 in a cubic millimeter, and of white cells at 7500 in a cubic millimeter, but the latter may vary in health from 5000 to 10,000. Coles, in his recent work, says that Hayem places the number at 6000 and von Lembeck at from 8000 to 9000. The proportion of white to red cells in normal blood is as 1 to 500 or 600. For clinical and diagnostic purposes a careful study of the various types into which the white corpuscles are divided is of the greatest importance.

It is very essential for the student to understand the few facts that follow, to enable him to differentiate the separate ages or forms of the white cells should he desire to make a blood examination for diagnostic purposes. The youngest white cell is the "lymphocyte," and the oldest is the "eosinophile," and the "polymorphonuclear" or "neutrophile" is the intermediate. The lymphocyte is the simplest and smallest, as well as the youngest, and consists of a small amount of protoplasm with a large nucleus. It measures from 6½ to 7½ μ. The neutrophile is made up of a large proportion of protoplasm which has already become granular, and an irregularly outlined nucleus, often horseshoe-like, always indented, more frequently presenting the appearance of many nuclei (possibly as many as five) entirely free from one another, but usually, upon closer examination, they will be found connected by small trabecular bands.

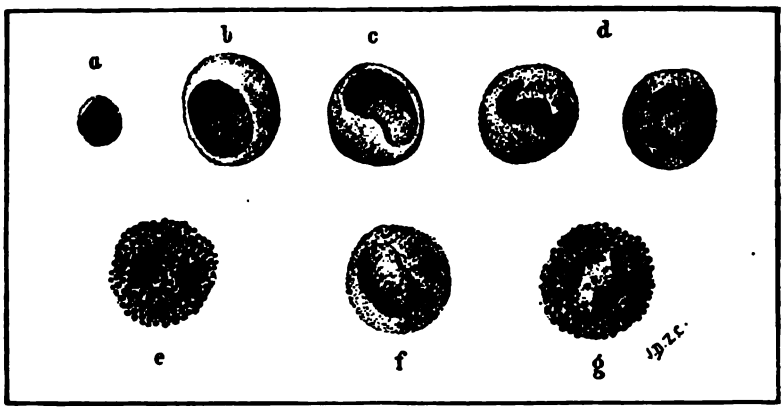


FIG. 31.

a. Small lymphocyte. *b*. Large lymphocyte. *c*. Transitional lymphocyte. *d*. Neutrophiles. *e*. Eosinophiles. *f*. Myelocyte. *g*. Eosinophilic myelocyte.

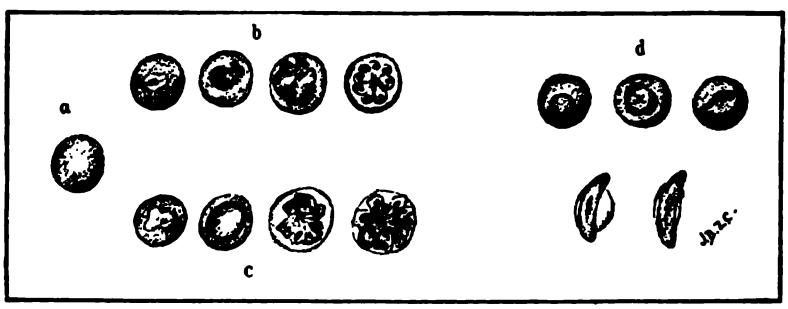


FIG. 32.

a. Normocyte. *b*. Parasites of quartan fever. *c*. Parasites of tertian fever. *d*. Parasites of estivo-autumnal fever.

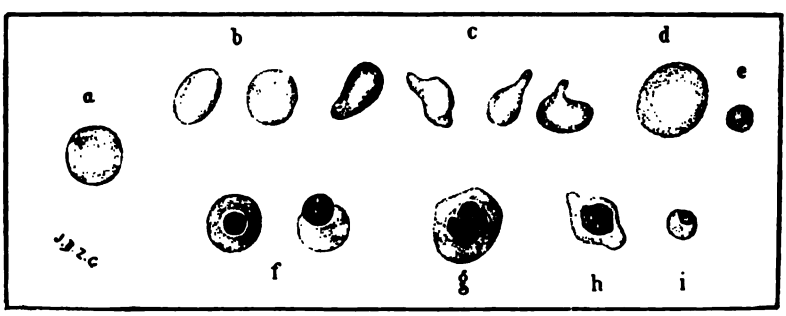


FIG. 33.

a. Normocyte. *b*. Normocyte deficient in hemoglobin. *c*. Poikilocytes. *d*. Macrocyte. *e*. Microcyte. *f*. Normoblasts. *g*. Megaloblast. *h*. Poikiloblast. *i*. Microblast.

The neutrophile is larger than the lymphocyte, measuring from 7½ to 9½ μ. The eosinophile is more highly granular, the granules being larger and more refractile than in any other normal cell, its nuclei being similar to that of the neutrophile. The size of this cell is from 8 to 9½ μ. Often white cells are observed which possess morphologically the same characteristics as the lymphocytes, but they are much larger, measuring from 8½ to 12 μ, and are simply named the "large" lymphocytes. A modification of this cell is one in which the nucleus becomes indented or kidney-shaped and its protoplasm shows a tendency to become granular. It is known as the "transitional cell." These varieties of cells bear certain numerical relations to one another, although different observers give different proportions, as will be seen from the accompanying table:

	Cabot. Per Cent.	Rotch. Per Cent.	Stengel. Per Cent.
Lymphocytes, small,	20 to 30	24 to 30	25
Lymphocytes, large,	4 to 8	3 to 6	3 to 6
Neutrophiles,	62 to 70	60 to 75	65 to 70
Eosinophiles,	0.5 to 4	1 to 2	Not over 3.

The red cells, also called erythrocytes, are biconcave discs, smooth, homogeneous, and without a limiting cell membrane. In health three sizes of these corpuscles are found, the larger ones, called "macrocytes" or "megalocytes," measuring from 8 to 9 μ, which constitute about 12½ per cent. The medium-sized corpuscles have an average diameter of 7½ μ, and constitute about 75 per cent. of the entire number. The small corpuscles, called "microcytes," measure from 6 to $6\frac{6}{10}$ μ, and constitute about 12½ per cent. (See Fig. 33.)

The study of the blood for clinical purposes is greatly facilitated by means of various stains. Multiple staining is practically always employed. Many workers prefer the double stain of eosin and hematoxylin or eosin and methyl-blue, while others use the triple stain, after the method of Ehrlich, the formula for which is as follows:

Saturated watery solution of orange G,	120 to 135 c.c.
Saturated watery solution of acid fuchsin,	80 to 165 c.c.
Saturated watery solution of methyl-green,	125 c.c.
Glycerin,	100 c.c.
Absolute alcohol,	200 c.c.
Distilled water,	300 c.c.

Eosin solutions are made to the strength of saturation, and the hematoxylin solution is prepared according to the formula of Delafield, which is:

Crystallized hematoxylin,	4 c.c.
Absolute alcohol,	25 c.c.

Mix and allow to stand two days, then add 400 c.c. of concentrated aqueous solution of ammoniac alum, stand aside for four days, leaving it uncorked and exposed to the light. Filter and add 100 c.c. of glycerin and 100 c.c. of wood-alcohol. This solution ripens in three to four months, and for careful work should not be used until it has been prepared for that time. For staining purposes a drop of blood is secured from the well-cleaned finger-tip or lobe of the ear upon a scrupulously clean cover-glass. Whichever site is selected should be carefully washed with soap and water, afterward with alcohol or benzin. A second cover-glass is quickly placed over the first, and by rapidly sliding them apart two smears are secured, which are dried by exposure to the air. An hour will suffice, although they can be kept indefinitely in this condition, and especially so if they be protected from air, dust, and moisture. The staining process is very simple. Heat the smears for about an hour upon a brass plate raised to such a temperature that a drop of water will evaporate rapidly from its surface, then stain for five minutes with a hematoxylin solution, which is then thoroughly washed off in running water, and the film afterward allowed to stand for two or three minutes in water. It is then again stained with eosin, and after drying is ready to be mounted in balsam. An oil-immersion lens should always be used for blood work.

General Pathologic Changes.—Before the study of hematology, the blood was considered, pathologically, solely from the clinical evidences of an increased or diminished quantity of the fluid in relation to the bodily weight. Little attention was paid to the quality or to the condition of the various constituents. *Plethora* was described as a condition in which there existed an excessive quantity of blood, and while it seems evident that a transient increase in the total amount of blood is a possibility, yet the condition is purely relative, and the symptoms observed are the result of vasomotor disturbances. The opposite condition to plethora was indicated by the term *anemia*, which was held to represent, in a general way, an impoverished state of the blood. *Oligemia* is the term used to express an actual reduction in the amount of blood without any reference to component parts. *Oligocythemia* expresses a decrease in the number of red blood-corpuscles, and *oligochromemia* expresses the diminution in the amount of hemoglobin in the blood. *Hydremia* expresses the fact that the watery element of the blood is increased beyond its normal amount, and *anhydremia*, a decrease in the same element. *Lipemia* expresses an excess of fat in the blood and is absolutely of no clinical significance, although it is found in a

number of conditions, such as phthisis, nephritis, diabetes, etc. *Melanemia* refers to pigments in the blood and occurs in some infectious diseases, but especially in malaria, in which disease it may be free in the blood after a paroxysm, although the pigment is normally contained in the corpuscles.

An increase in the number of the white cells may affect all varieties of these cells, but especially the lymphocytes and neutrophiles, constituting a condition known as *leukocytosis*. A physiologic increase of the white cells is at times observed, and especially is this liable to occur after eating, an hour or so after which the white corpuscles may be increased to 9000 or 10,000 in a cubic millimeter. In infants this is especially marked. A pure lymphocytosis is very rarely seen, and is said to exist when the number of white cells reaches 10,000 in a cubic millimeter, and consists of an increase of the lymphocytes.

Leukocytosis, as a physiologic condition, exists in pregnancy, as a result of postpartum hemorrhage, after violent exercise, a cold bath, and massage. The moribund state is also accompanied by a leukocytosis. Pathologically, we are confronted by leukocytosis most frequently after all inflammatory conditions, and a general law may be laid down that the leukocytosis bears a direct relation to the severity of the infection and to the powers of resistance of the individual. In the weak and emaciated, with low resisting power, a severe septic infection will not cause such a degree of leukocytosis as a similar condition would give rise to in the strong and vigorous. Should the disease be very acute and spreading, the leukocytosis is more marked than when it has become limited and walled off. This has been more thoroughly studied in appendicitis than in any other disease. Cabot has carefully tabulated many diseases during the course of which a leukocytosis is found. Among children it is most frequently seen in the infectious diseases: scarlet fever, diphtheria, follicular tonsillitis, pneumonia, smallpox, cerebrospinal meningitis, and among the septic diseases, appendicitis, abscesses of all regions, except those of tubercular origin, and many forms of skin diseases. When leukocytosis is absent in croupous pneumonia, it is a very bad prognostic sign. Many diseases that produce toxemias also produce leukocytosis. It is, however, normally absent in typhoid fever, influenza, malaria, uncomplicated measles, and almost all tubercular conditions, so long as there is not a mixed infection.

There are certain intrinsic changes in the red blood elements which are important in diagnosis. An increase in the proportion of small red cells is called *microcythemia*, and an increase of the large cells is called *macrocythemia*. The importance

of microcythemia has not been clearly made out, while macrocythemia is associated with all the severe anemias. When any alteration occurs in the size of the corpuscles, there are usually found associated changes in their forms. Poikilocytosis is the term used to designate all these changes in shape. Corpuscles may be rod-shaped, pear-shaped, etc., assuming various forms, in the place of the uniformly round body. Occasionally all the cells may appear uniformly but irregularly outlined, owing to faulty technic.

Red blood-corpuscles only stain as they die, and normally take an acid stain (eosin), but in a number of diseases, such as severe anemia, scarlet fever, and smallpox, a few red corpuscles take on in parts the second stain. This condition is called *polychromatophilia*, and is an evidence of cell degeneration. One observer considers it an evidence of cell death. Red corpuscles may show small knobs projecting from the spheric border, which become detached and float in the plasma. Red blood-corpuscles in disease take on the fetal phenomenon of *nucleation*. Nucleated corpuscles floating in the peripheral blood are comparatively rare, and it may require many examinations of the same specimen to find them. *Nucleated corpuscles* are of three sizes: the normoblast, the microblast, and the megaloblast. Normoblasts occur normally in bone-marrow, and are regarded as an immature red cell. Their presence in the circulation always points to such blood changes wherein the demand for new material has been greater than the supply, and where raw material had to be drawn from. On the contrary, a megaloblast is always foreign to the healthy body, and is only found pathologically and in the fetal marrow. Its presence is indicative of a severe anemia. In size it is always over 10 μ, and, according to Cabot, may be as large as 20 μ. It is often polychromatophilic. The nucleus is very large, staining less intensely than a normoblast, and, as a rule, uniformly. When present, it is an evidence of a return to the fetal hemogenesis, and that the bone-marrow has become very seriously deranged in its function of blood formation. Megaloblasts may also be poikilocytes. Microblasts are smaller than the ordinary red cells, and have probably no significance other than that of normoblasts or megaloblasts. In general the nucleated red cells are evidences of severe trouble, and occur both in primary and symptomatic anemias. Coles says that normoblasts may always be looked for when the red cells do not exceed 2,500,000 in number. However, it should be stated that the anemia following hemorrhage must be very severe before nucleated red cells are found. At any time when the megaloblasts

exceed the normoblasts the condition of the patient is very serious, and especially is this true if the megaloblasts are also poikilocytes. Red cells may sometimes contain granular and hyaline masses, the result of the parasites of malaria, which will be described when speaking of that disease.

Myelocytes, or marrow-cells, never occur in normal human blood, but they are very common in the red bone-marrow and are characteristic of mixed and splenomedullary leukocythemia. Their diameter may reach 20 μ. The nucleus is usually single and faintly stained, occupying a very large part of the cell, the remainder of which is highly granular. Occasionally myelocytes are small, and were it not for the fact that the granules take up certain stains, such as Ehrlich's neutral stains, they could not be distinguished from large and small lymphocytes. These granules do not stain with hematoxylin. The nucleus is often lobed. Myelocytes contain at times eosinophilic granules, and are then called eosinophilic myelocytes. The chief changes in the white cells are in their numbers and proportions, which are determined by the differential count.

The granules found in the white cells are of five varieties: Those which are stained by the acid stains and are called "eosinophiles," the granules of which are large and round; these exist in the normal blood. "Amphophiles" contain small round granules which take both acid and basic stains and do not normally exist in the human blood, but in the medullary cavity of bones and in the leukocytes of some of the lower animals. The so-called "Mast-cell," which is a basophile,—that is, takes a basic stain,—contains coarse, round, and poorly refracting granules. Ehrlich believes they do not occur in the blood normally, but if found in any number, are pathognomonic of leukocythemia. Ordinary stains do not show the granules, but they can be readily brought out by the use of the following solution, in which the films should lie twenty-four hours:

Dahlia, saturated alcoholic solution,	50 c.c.
Glacial acetic acid,	10 to 15 c.c.
Distilled water,	100 c.c.

The granules may also be stained with methyl-blue. The next variety is only distinguishable by the size of the granules, which are smaller and are also spoken of as Mast cells. Both of these cells are mononuclear, measuring about 20 μ. "Neutrophiles" are those cells in which the granules take only the neutral stain. The granules are fine, and fill up a large portion of the protoplasm of the cells. In regard to both varieties of the

Mast cells, there is at present a great deal of doubt in the minds of different observers. The eosinophilic granules he calls α, the amphophilic β, the two varieties of basophilic γ and δ respectively, and the neutrophilic ε.

Blood of Infants.—In infancy the hemic equilibrium is remarkably unstable and subject to great changes from trivial causes. Diseases which ordinarily cause a slight leukocytosis in an adult, cause marked increase in the infant; especially is this the case with anemia. Normally the blood of a very young child does not correspond to the facts recorded of adult blood. In the count of the red blood-cells of an infant it is often found that there will be an increase of from 500,000 to 1,500,000 over that of a normal adult. In the count of white blood-corpuscles we so frequently find an increased number that we may almost assume that a leukocytosis is normal in infancy. Cases have been reported where there were 20,000 leukocytes during the first few days of life, and this number increased to 25,000 after each nursing. This *post cibium* increase illustrates the fact that the blood of infants is readily affected by trivial affairs, for while there is an acknowledged leukocytosis in an adult after eating, it never occurs in anything like this degree. Equally remarkable with the physiologic leukocytosis is the proportion in the respective varieties, as shown by differential count. The lymphocytes are found to be more numerous than in adult blood, being oftentimes 50 to 60 per cent. of the whole, in the place of 20 to 30 per cent., as in adult blood. This increase is at the expense of the neutrophiles, which oftentimes are only 20 or 30 per cent. in the place of 60 to 70 per cent.

Phagocytic action takes place in the neutrophile cells, demonstrating the slight power of resistance in infancy. The red cells, also, show changes in infants which in adults would be pathologic. They may be altered in shape and size as well as nucleated (of the variety of normoblasts).

The **instruments used in the inspection of the blood** are the microscope, the hemocytometer, the hemoglobinometer, the hematocrit, and the spectroscope.

Within recent years the literature upon this fascinating subject has been richly increased, and the reader is referred to that for more detailed descriptions of the instruments used and the technic employed, which can not be given in this chapter.

ANEMIA.

Anemia is divided into two classes, primary and secondary. First, the class of primary anemias containing all those disorders which are essential and in a direct manner related to or dependent upon the blood-making organs, and, so far as we know, bear no relation to any extraneous causes. This class includes chlorosis, leukocythemia, pernicious anemia, pseudoleukemia infantum, and Hodgkin's disease.

Second, the secondary or symptomatic anemias, which are the result of some other distinct disease or derangement of function and are not due to disorders of any of the organs or tissues directly concerned in the blood-making function. Hemorrhage from any cause presents the most perfect example of a secondary anemia. It is also found to exist in association with, and after, acute fevers, infectious diseases, tubercular diseases, syphilis, acquired and hereditary, rachitis, malignant growths, and especially in children after gastric or intestinal diseases. Morphan believes that primary anemias do not exist in nurslings, and that these and the enlargements of the various organs taking part in the production of blood depend upon some acute or chronic infection. He also believes that hypertrophies of the spleen, liver, and lymphatic glands are very prone to appear in any of the anemias of childhood.

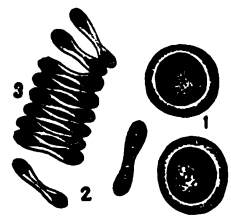


FIG. 34.—HUMAN COLORED BLOOD-CORPUSCLES.—(*After Landois.*)
1. On the flat. 2. On edge. 3. Rouleau of corpuscles.

In all forms of anemia the so-called hemic murmur can be found. However, in the anemia of children these inorganic murmurs are very rare until after the third year. In all anemias of children, and particularly of infants, the changes found in the blood are much greater than those under similar conditions in the adult. These changes consist of a nucleation of the white corpuscles and in increase in the proportion of the lymphocytes, associated at times with irregularly shaped red cells.

PRIMARY ANEMIAS.

CHLOROSIS.

Synonyms.—CHLOREMIA; GREEN SICKNESS.

Definition.—Chlorosis is an essential anemia occurring chiefly in young girls at about the period of adolescence. It is charac-

terized by a diminution in the percentage of hemoglobin, the various evidences of anemia, and changes in the vascular system.

Causes.—Among the predisposing factors which are potent in the causation of this disease sex stands preeminent. Chlorosis seems to be confined chiefly to the female sex, and is rarely seen in other than ill-nourished girls about the age of puberty, although cases have been reported in females before reaching this period by Nonat and others. Chlorosis exists in boys in a somewhat modified form. Heredity undoubtedly plays an important part as a predisposing cause. The statement that light-haired girls of poor vitality are especially predisposed to chlorosis has been generally refuted, although the question is still unsettled. The causes which may be directly responsible for the development of the disease are, on one hand, overwork and poor nourishment, and, on the other, indolence, vicious habits, and bad sanitation. Powerful nervous impressions may act as strong influences in the development of the disease.

Pathology.—Many have looked upon chlorosis as dependent upon disturbances of menstruation, and not a few have held to the theory that gastro-intestinal disorders are the cause of this disease. So far the causative element has not been demonstrated, but the consensus of opinion is that chlorosis is dependent upon imperfect nutrition and sanitation. It may also depend upon a copremia due to absorption from the bowels of ptomains or leukomains.

Anatomic Changes.—The heart and blood-vessels in chlorosis are in a state of hypoplasia and are usually ill developed. Fatty degeneration of the cardiac muscle and arterial coats has frequently been demonstrated. The same condition of hypoplasia is often seen in the genital organs, they frequently presenting an infantile appearance. While any or all of the foregoing changes may be noted, they are by no means constant.

Blood Changes.—The specific gravity of the blood in chlorosis is low, being often only 1035. On account of this low specific gravity and the inaccuracies of the von Fleischl apparatus in low readings, the table on page 354 will be found useful in studying this disease. The color of the blood as it flows from a prick wound is light. Coagulation takes place rapidly, and manipulations therefore must be rapid. The blood is obviously thin and watery.

The essential change in the blood is a decrease in the actual amount and percentage of hemoglobin present in each corpuscle. There is probably no diminution in the total amount of the blood.

The reduction of the hemoglobin occurs with or without a material decrease in the red corpuscles, while in the severer cases they are decidedly decreased in number. Should the case be put upon the usual treatment of iron and arsenic and observations frequently made, the red blood-corpuscles may be found increased in number and the amount of hemoglobin stationary, or nearly so. The color index is always low, being from 0.5 to 0.35 or even to 0.3.

The average amount of hemoglobin in chlorosis is about 40 per cent. Out of 247 cases mentioned by Coles, as tabulated by various writers, 40 per cent. showed a blood count of 4,000,000 corpuscles, and 60 per cent. of less than that number. It is rare to find a very low count, such as occurs in pernicious anemia. The diminution of the hemoglobin is found after certain diseases, while the blood is being regenerated, but not to the same degree as in chlorosis. Certain changes take place in the red corpuscles. Microcytes exist and may be so numerous that the general average of the diameters of the blood-corpuscles is reduced. The corpuscles may be changed in shape, but the degree of poikilocytosis is not dependent upon the decrease of the red cells.

In staining specimens many red cells fail to take on the average amount of staining. Polychromatophilia exists, demonstrating the mortal changes in the cells. The occurrence of nucleated red cells has been denied by some writers, but the positive evidence of others would seem to settle the matter. They occur only in very severe cases and are usually normoblasts, while the occurrence of megaloblasts in the most extreme cases is rare.

In all uncomplicated cases of chlorosis the white cells remain about normal. There is never a leukocytosis, though there may be a diminution of the white cells. Rarely a few myelocytes are found. Cabot records a table of white-cell counts in which the highest count was 15,000 and the lowest 1500; the average was 7485. In those cases where the count was high there was some other condition prevailing.

Symptoms.—The premonitory symptoms of chlorosis are varied, sometimes rather vague. Frequently they are unnoticed, except that the patient, before in good health, develops a gradual increase in lassitude, which is often attributed to the onset of puberty or the effect of overwork. Later there are menstrual irregularities. Shortness of breath and palpitation of the heart are complained of frequently. Headache is common; in fact, in some cases may be almost constant. Dizziness and weakness, increased upon standing and walking, are usually noticed. The

digestion becomes weak, the appetite fails, and the patient often craves abnormal articles of food. The skin develops a peculiar greenish-yellow tint which is eminently characteristic of the disease. The mucous membranes become pale, and the conjunctivæ in severe cases almost colorless. In some cases the cheeks and lips retain their natural color, even though the hemoglobin shows a pronounced reduction. To this class of cases Wendt has applied the name of chlorosis florida or chlorosis rubra. Occasionally marked pigmentation is observed in the neighborhood of the joints. Edema beneath the eyes and of the malleoli is commonly observed, and oftener toward the end of the day than in the morning. There is a tendency to the accumulation of fat, making the patient, as a rule, rather flabby than emaciated. The disturbances of circulation are generally manifest by visible pulsations of the veins of the neck. Coldness of the extremities and palpitation of the heart are very frequently complained of. The pulse is generally rapid and weak. Examination of the heart seldom reveals any change in its size. The apex-beat is usually visible and strong; hemic murmurs are heard upon auscultation, most frequently over the pulmonary area, and at times a soft systolic bruit may be elicited at the apex. Not infrequently a hemic murmur will be heard over the right jugular vein. This is sometimes known as the *bruit de diable*, or "humming-top" murmur. Hemorrhages are not uncommon, and may be due to degeneration of the arterial coats or to the blood itself. The nervous symptoms are many and varied; cephalalgia and neuralgia are rarely absent, while hysteric manifestations of a varied and sometimes grave character are not at all uncommon. Optic neuritis and neuroretinitis have been recorded as symptoms by Gowers.

Complications.—A large number of cases of chlorosis present no complications. Occasionally, however, endocarditis and enlargement of the thyroid gland are seen. Thrombosis of the veins was first observed by Trousseau, and occurs more frequently than is generally supposed. Gastric ulcer, nephritis, and phthisis are frequent complications.

Diagnosis.—Anemia in a young woman with cardiac, digestive, and menstrual irregularity, a greenish-yellow tint of the skin, certain nervous disturbances associated with a diminution of the hemoglobin, very little changes in the blood count as compared with the decrease in the hemoglobin, render the diagnosis easy. We are able in no instance to depend upon the blood examination alone for the diagnosis, or we should be confusing it with syphilis, tuberculosis, malignant diseases, and other dis-

eases which present secondary anemia. Leukocytosis is very common in secondary anemia and absent in simple chlorosis.

Prognosis.—The prognosis of chlorosis is favorable. There are exceptional cases, however, which resist treatment. Chlorosis is generally amenable to treatment in from six to eight weeks, but sometimes it is most obstinate and prolonged.

Treatment.—In chlorosis, as well as in the various symptomatic anemias, special attention should be given to the environment of the patient. In many cases the rest cure or one of its modifications will be found necessary. This method of treatment is particularly applicable to those patients whose lives have been spent at hard work in a close atmosphere. For those whose means will allow it, a sea voyage is to be recommended, and in cases where this luxury can not be had, quiet recreation in a neighboring park or several hours spent in the sunshine in a public square should be insisted upon. Medicinally, iron can be claimed as a specific in the disease, and of all the forms of iron which we have at our command, Blaud's pills, containing equal parts of the dry sulphate of iron and the carbonate of potassium, have probably given the most satisfaction. Where, for any reason, pills can not be taken by the patient, the powdered saccharated carbonate or some liquid preparation of iron should be used. The tincture of the chlorid will often be found extremely beneficial. Da Costa says the occasional use of the ferrous manganese citrate has given satisfactory results. During a long course of iron treatment constipation will sooner or later result, and therefore the administration of the drug should be so regulated as to avoid this objectionable feature. The natural iron waters are here of special use. Constipation can generally be overcome by the occasional use of small doses of a laxative—a saline, cascara, senna, or bowel irrigation. Next in efficacy to iron in the treatment of chlorosis is arsenic. The good results of the latter are much increased in many cases by combining arsenic with iron. Arsenic may be given in increasing doses until a decided physiologic action of the drug is obtained. In most cases massage will be found an admirable adjunct in the treatment. A powerful agent in combatting the effects of anemia is systematic deep breathing and respiratory gymnastics.

Simple Primary Anemia.

Simple primary anemia *per se* is a condition about the existence of which there has been some doubt, but many describe it as a special condition. It occurs without any distinct pathologic

alterations, and is not associated with any severe or marked constitutional symptoms other than those which occur in chlorosis or any other disease where there is a diminution of the blood or of its normal elements. Its etiology is doubtless due to the effects of poor hygienic surroundings and a consequent lack of proper activity of the blood-making organs. One very important fact is the rapidity with which the blood reaches its normal level when the patient gets fresh air, proper food, and exercise. The changes in the blood are a proportionate diminution of the red cells and of hemoglobin. In the severer cases evidences are shown of degeneration in the blood-cells in the form of megalocytes, normoblasts, and megaloblasts. Microcytes may also be found. There is also a decrease in the hemoglobin out of proportion to the number of the red cells. The red-blood count falls as low as 1,000,000, and the hemoglobin to 30 or 40 per cent. This extreme is very exceptional. The white cells show no changes beyond that expected from a decrease in the general tone of the blood. In those cases where there may be a leukocytosis or a relative change in the quantity of lymphocytes or neutrophiles, some other condition must be searched for.

Splenic Anemia.

Synonym.—Splenic Pseudoleukemia.

There is a decrease in the number of red corpuscles, microcytes are quite numerous, and there is a loss of hemoglobin out of proportion to the decrease of the red cells. The color index is low and the leukocytes are unchanged.

Leukocythemia.

Synonyms.—Leukemia; White Blood; Anæmia Splenica.

Definition.—Leukocythemia is a primary or essential anemia, characterized by excessive increase in white blood-cells and by an enlargement of the spleen or lymphatic glands, with changes in the bone-marrow.

Causes.—Leukocythemia may occur at any period of life from infancy to old age, and although comparatively a rare disease, it is as common among the rich as the poor. The infectious origin of the disease has been urged ably by many good observers, but no proof is exhibited as yet.

Among the predisposing causes heredity has commanded considerable attention. Instances are recorded bearing proof of the

importance of this factor in the development of the disease. Leukemia has been frequently met with after severe attacks of malaria. However, the latter disease is looked upon as a predisposing rather than an exciting cause. Syphilis, rachitis, typhoid fever, and severe hemorrhages have all been mentioned as predisposing causes. The exciting cause of the disease has not yet been determined.

Pathologic Anatomy.—Leukemia is essentially a disease of hemogenic alterations in the blood-making organs. The lymphatic structures are principally involved, and pathologic lesions are noticed in the spleen and bone-marrow.

From this fact three varieties of leukocythemia have been described: a splenic, a medullary, and a lymphatic. However, since pure splenic cases and medullary cases rarely, if ever, occur, though there is no doubt that one or other of these elements may at times predominate, it is wise to outline but two classes of leukocythemia. This is especially noted in the works of the later writers, who declare that the splenic and medullary varieties are always blended and that even the lymphatic variety may be associated with the other two. The divisions of leukocythemia, then, are first the splenomedullary, in which we find the spleen enlarged, congested, and infiltrated with leukocytes, and the bone-marrow of the long and spongy bones of a yellowish hue, either in small patches throughout the marrow or uniformly present. This material may be firm at first, though in time it softens down and eventually much resembles pus. The fat has been replaced by a purulent or, as Newman says, a pyoid, material. The microscope shows both varieties of marrow-cells, and on account of the very large number of cells showing karyokinesis and in the process of division, it is evident that proliferation has been going on. The nucleated red cells lie along the periphery of the marrow. The occurrence of these cells in the blood is explained by the escape of all these elements from the bone-marrow into the blood. The cause of this condition has not yet been determined.

Second, lymphatic leukocythemia is characterized by the enlargement of the lymphatic glands and the substitution of lymphoid tissue for the bone-marrow. This lymphoid tissue consists of small mononuclear lymphocytes and some nucleated red cells. The spleen in this variety also shows some enlargement. The lymphatic glands are not always enlarged, nor does the spleen always appear to take a minor part, since in rare cases it is quite large. The essential feature is an excessive proliferation of the lymphocytes. The cause of this condition is not known. In

this disease the white cells show a very appreciable increase when examined by the hematocrit.

The Blood in Leukocythemia.—There are certain facts about the blood that apply to both forms of leukocythemia. Its color is usually normal, though when the white corpuscles are very numerous, it is described as chocolate, but it sometimes looks like pus and blood mixed, or it may be very pale. Its specific gravity is low, its reaction is alkaline, and it coagulates readily. Under the microscope, without stain, the disproportion can be seen between the white and red cells, and if it be a splenomedullary case, the large size of the white cells can be noted. The leuckocytes are enormously increased in number, sometimes as many as 500,000 being found, and a count of 100,000 to 200,000 is not unusual. The proportion of white to red may be 1 to 12, while that in health is 1 to 500 or 600. A few remarkable cases have been reported where the proportion was 1 to 2. It is important to understand that it is not the actual number or proportion of the white cells present which makes the diagnosis, but that it is the character of the cells. A leukocytosis exists oftentimes to a very marked degree, while the normal ratio of the different varieties of white cells remains; in other words, it is quality we look for and not quantity. In leukocytosis, if any intercurrent and infectious disease should arise, the leukocytes grow fewer in a remarkable degree.

Splenomedullary leukocythemia is the commoner of the two forms. Should one not have at hand a case of the disease to study, it can very readily be worked up from the bone-marrow of a kitten mixed with its ordinary blood. The alterations are in the forms and varieties as well as in the number of the leukocytes. The blood should be stained for study. The characteristic cell is the myelocyte. The existence of the myelocyte in a blood-stain will not establish the diagnosis, but when these cells exist in large numbers, then it would be just to make this diagnosis—30 to 50 per cent. of all leukocytes seems to be the average number. The neutrophiles are very much decreased in relative numbers, though the actual number of these cells present may be enormously increased. The differential count shows about 50 per cent. of neutrophiles, occasionally dropping as low as 15 to 20 per cent. They are smaller and more irregular in shape than in health. The eosinophiles are increased, averaging, according to Cabot's table, $4\frac{4}{10}$ per cent. In one case there was 11 per cent.

There are three classes of eosinophiles present: First, the ordinary polynuclear eosinophile; second, a small eosinophile

that is deeply stained with eosin and that does not occur in the human blood, and which has been thought to be characteristic of this state; third, the eosinophilic myelocyte, which never occurs in health and is characteristic of this disease. The lymphocytes, as a rule, are much reduced in their proportion, being often as low as 5 per cent. in the place of from 15 to 25 per cent., as in health. Karyokinetic figures may be found.

The number of red cells is not extremely diminished, being reduced from two to three millions. The shape and size remain about the same. Nucleated red cells are constantly found in leukocythemia, and it is said that this is the only disease in which they occur in such numbers. They are normoblasts, with an occasional megaloblast. The hemoglobin is decreased in proportion to the decrease of the red cells. Blood plates are increased, and Charcot-Leyden crystals are found in dried specimens.

Lymphatic Leukocythemia.—This form is rare and more acute than the preceding disease; it is characterized by an increase in the size of the lymphatic glands and the occasional enlargement of the spleen, and by the following blood changes: There is an increase in the white cells which is never so extensive as in the splenomedullary type, ranging about 150,000 cells in a cubic millimeter, though there may be as low as 40,000 or as high as 450,000. Lymphocytes predominate, and may form as much as 95 per cent. of all of the white cells. In no other disease does such a state constantly exist. The lymphocytes are large and small, depending upon the case. A few myelocytes may be found. Red blood-corpuscles and hemoglobin are diminished, and nucleated red cells are rare.

Symptoms.—Leukocythemia usually comes on so insidiously that the patient does not become aware of his condition until the disease is fairly well developed. The early symptoms are those of a developing anemia, with its attending phenomena of weakness, cardiac palpitation, shortness of breath, and pallor, together with hemorrhages from the mucous membranes. Pain in the splenic area not infrequently ushers in the attack. Priapism has been cited by Edes and others as an early symptom of the disease. The abdomen soon becomes noticeably increased in size, due to the enlargement of the spleen and various lymphatic structures. There is considerable fluctuation in the size of the spleen; examination may show the organ to be hypertrophied to such an extent as to reach the spines of the ilia, while a subsequent examination, after a lapse of some hours, may reveal the organ decreased to one-half of its former size. The involvement

of the lymphatic glands, especially those of the neck, is very common. These glands are of stony hardness, and apt to produce pressure symptoms, impeding respiration. Vertigo is constant, and is generally caused by the intense anemia. The skin is of a pale, ashen color; sometimes it has a dirty yellow hue, but, as in chlorosis, the patient may preserve the healthy hue of the cheeks, which appearance is very deceptive. Various skin-lesions, as noted in the pathology, are apt to develop, and subcutaneous edema is rarely absent. The pulse is quick and compressible; hemic murmurs are heard at the base of the heart and in the vessels of the neck. The circulatory disturbances are simply those of intense anemia. The liver is nearly always enlarged, and gastro-intestinal symptoms prevail. Diarrhea and vomiting are occasionally met with. The tendency to hemorrhage is a marked feature of the disease, and cases are recorded in which the loss of blood in a single flow has been such as to endanger the life of the patient. Nervous symptoms, as a rule, are not well marked; of these, headache and melancholy are the most constant.

Diagnosis.—The diagnosis of leukocythemia is often surrounded with many difficulties. Hodgkin's disease and the condition of leukocytosis are apt to be confounded with it. In Hodgkin's disease we have either no increase of the leukocytes or, if any, only a very moderate one, and if there be an increase, it is in the neutrophiles. Between this and leukocythemia it is only during a remission that the diagnosis could be questioned. Leukocytosis can be differentiated by a failure to find myelocytes, an increase of neutrophiles and lymphocytes, and also by the absence of pathologic red cells and by the number and proportion of the neutrophilic leukocytes. Typhoid fever can easily be differentiated by the absence of leukocytosis. Frequent counts of the red and white cells and microscopic examination of stained slides are the only methods of making an absolute diagnosis.

Prognosis.—The course of the disease is chronic, and the prognosis is extremely grave.

Treatment.—Cases have recovered. Absolute rest is of primary importance. The personal hygiene should be carefully attended to; easily digested diet should be given, attention being directed to the quantity of food given at each meal. Arsenic has proved by far the most valuable of all drugs recommended in the treatment of this disease. Fowler's solution in increasing doses is perhaps the most efficient method of administering the drug. Quinin, iron, and strychnin prove valuable only as general tonics. Symptoms should be treated as they arise. In regard to the re-

moval of the large, painful spleen, the operation of splenectomy has proved disastrous in every case save the first one, and is therefore inadvisable.

Pseudoleukocythemia Infantum.

This disease is associated with an enlargement of the spleen and a moderately enlarged liver, sometimes enlargement of the lymphatic glands, with a decrease in the hemoglobin and red blood-cells and a degree of leukocytosis. Nucleated red blood-cells have been described, and poikilocytosis may occur. It is a disease that occurs in early infancy and usually runs a favorable course. The child is very pale and waxen in appearance. Recent writers consider it a secondary condition and think that the changes noted depend upon some gastro-intestinal condition and the age of the patient.

Progressive Pernicious Anemia.

Definition.—A grave progressive form of anemia, dependent upon hemolytic disturbances, characterized by the presence of abnormalities and a great reduction in the number of red corpuscles without a corresponding loss of hemoglobin, and almost invariably ending in death.

Causes.—The true cause of this disease is unknown. It has been asserted that ptomains absorbed from the alimentary canal were instrumental in its etiology. This, as well as the infectious theory, has not been substantiated. Pernicious anemia occurs in middle life, but occasionally may be seen in children. It is, however, rare in the earlier years of life.

Morbid Anatomy.—The skin presents a pallid, yellowish cast, and this pallor may be shared by the mucous membranes. The muscles in contrast to the external organs are remarkably red in color. A considerable amount of serous effusion is occasionally met with, especially in the pleura and pericardial sacs. Patches of ecchymosis are frequently observed upon the skin, the mucous and serous membranes, and upon various organs of the body. Small hemorrhagic extravasations are frequently met with upon the retina in the neighborhood of the optic disc. Fatty degeneration of the heart is most constant. The appearance of the endocardium is particularly striking; it is caused by degeneration, and from the peculiar mottled appearance has been called "tabby mottling." The lungs, as well as the spleen, present no constant pathologic lesions. The liver is not infrequently enlarged, pale, and shows evidences of fatty degeneration. Many observers

have attached special significance to the condition of fatty degeneration and hypoplasia of the connective tissues found in the stomach, but this condition may generally be looked upon as a result, rather than a cause, of the disease. The pancreas and kidneys are usually softer and larger than normal and show evidences of fatty degeneration. Marked degeneration has been seen in the posterior columns of the spinal cord, the cervical region being most markedly affected. The disease is regarded as a destruction of the blood, and not as a disease of the blood-making organs. The destruction theory is upheld by the deposit of pigment through the various organs and the presence of jaundice and hemoglobinuria. The changes in the bone-marrow are the substitution of red bone-marrow, as in fetal bones, for fat; the presence in this marrow of a large number of red nucleated cells and megaloblasts and also larger cells called gigantoblasts. These bone-marrow changes are secondary.

Blood Changes.—On puncturing the skin, the blood does not flow freely and is very thin and pale, though oftentimes of a dirty brown. On account of its thinness it is often difficult to get enough to fill the pipet preparatory to counting, and after standing for a short time the corpuscles separate from the serum. Rouleau formation may be absent. Spreading the films is unsatisfactory for the same reason. The red cells are decreased in number in this disease beyond that found in any other condition. At the first examination a count of 2,500,000 is to be expected, and a few cases have been reported in which only 360,000 red corpuscles existed. A count below 500,000 is not very unusual. An apparent recovery sometimes occurs during the course of treatment, and a case has been reported in which the count returned to normal. After such a remission the relapse rapidly throws the count down to a very low figure. Hemoglobin is much reduced, though the color index is often high. The hemoglobin may be only 15 per cent.

The red cells show many changes both in the size and shape of the cell. In health about 12 per cent. of the red cells measure $8\frac{5}{10}\,\mu$, and in this disease we find megalocytes, or giant cells, that measure from $8\frac{1}{2}\,\mu$ to $12\,\mu$, though these rarely constitute more than 12 per cent. of the red cells. The commonest size is $10\,\mu$. These are only found in health in the new-born and under pathologic conditions in the adult. These megalocytes may be oval or pyriform. Microcytes also exist, but have no special significance. The color of the individual red cells varies a good deal. The megalocytes are often paler than the normal cells, and the microcytes may take a very deep stain, while others

appear purely as shadows of cells in which we see only a faint ring or a small amount of granular matter. Some, and especially the megalocytes, take both stains (polychromatophilic), and others show small dark granular points, which condition is known as "pinctosis." Vacuoles are found in the protoplasm of these altered cells. All these phenomena are evidences of degeneration. The shape of the cells is changed very much: they may be pear-shaped, oval, star-shaped, rod-shaped, lance-shaped, fusiform, crescentic, or kidney-shaped, constituting the best-marked example of poikilocytosis. In fact, some specimens show very few normal appearing cells. Nucleation of the red cells is said to be a common feature of this disease, a fact that a few writers deny. It takes great patience and time to determine positively that this sign is absolute. Nucleation may occur in a poikilocyte, in which case it is called a "poikiloblast." It occurs in cells of all sizes, so that we find microblasts, normoblasts, and megaloblasts. The more megaloblasts that one finds, the worse is the prognosis, and especially so as regards time. Nuclei may be found free in the serum of the blood. The red cell takes a high degree of stain. Cabot puts the average number of white cells at about 4200; the only other change that occurs is a relative increase of the small lymphocytes.

Symptoms.—The term "progressive pernicious anemia" expresses the clinical conditions of the disease, which begins with a slight systemic disturbance, the disease progressing with more or less rapidity to a fatal termination. Increasing languor denotes the development of the affection. Oftentimes there is an early rise of temperature, with marked irregularities. Shortness of breath and vertigo are constantly complained of, and there is a great tendency to attacks of syncope. Toward the end extreme weakness confines the patient to bed. The skin presents a lemon-yellow color and is harsh and dry. Palpitation of the heart is always present and becomes extremely marked upon the slightest exertion. Endocardial murmurs are rarely absent, and the apex-beat is usually displaced considerably. The heart-sounds, although strong at first, rapidly become weak and muffled, showing evidence of fatty degeneration in the heart muscle. The pulse is short and weak, and a venous murmur is readily elicited in the vessels of the neck. Patients affected with pernicious anemia are, as a rule, flabby, but reasonably well rounded. The bodily strength rapidly decreases, showing marked muscular degeneration. Patches of ecchymoses are often observed on the skin and mucous membranes, and edema of the extremities is most constant. The appetite

is soon lost, and digestive disturbances are often present. As the disease progresses hemorrhages frequently occur without seeming provocation, and blindness, due to extravasations near the optic disc, has often been observed. There are no nervous symptoms peculiar to this disease, those present resulting from the aggravated condition of anemia.

Diagnosis.—A careful history must be elicited in a suspected case of the pernicious forms of anemia in order to exclude symptomatic anemias. The peculiar appearance of the patient and characteristic changes in the blood, as seen microscopically, together with the history of the case, are, as a rule, conclusive in making a diagnosis. It is not always, however, so easy to make a diagnosis as one would think from reading the account of the characteristic cases. The absence of emaciation, the failure of iron to produce results, the hemorrhages, the fever occasionally occurring, and the complexion of the patient should always be considered in a difficult case. Poikilocytosis is not associated with pernicious anemia alone, but is found in any other severe anemia. The presence of megaloblasts and gigantoblasts is of great weight when found as favoring pernicious anemia. In chlorosis the relative amount of hemoglobin is decreased, while in pernicious anemia it is proportionately higher. In the latter the size of the corpuscles is usually larger, which is not the case in chlorosis, though nucleated red cells and poikilocytosis may exist. Rarely would secondary anemia give us any trouble. If it should, it would probably be in a case of malignant disease, in which case the points already mentioned should serve to distinguish the form of the disease present, so far as the blood is concerned.

Prognosis.—The prognosis in pernicious anemia is extremely unfavorable. At times there are temporary improvements, but a fatal termination invariably occurs, either from the disease itself or from some intercurrent affection.

Treatment.—Of all medicinal agents, arsenic has proved the most beneficial in pernicious anemia and to a certain extent has even influenced the prognosis. It is generally advised that this drug be given in tablets, or at any rate alone. Good results have been obtained from the use of the chlorid of arsenic, and Fowler's solution has also been highly recommended. Combinations of iron and arsenic have sometimes been used with good effect, but the former drug is of less use in this form of anemia than in others. Stimulation of the patient is of great importance. Equalization of the blood pressure should be attempted, either by the use of intravenous injections or massage. The condition of the

stomach and intestines is of the greatest importance, and great care must be used in the administration of remedies that the digestive apparatus be not disturbed. The use of bone-marrow has been tried in this disease, but has not proved of direct value.

Hodgkin's Disease.

Synonyms.—Pseudoleukemia; Lymphatic Anemia.

Definition.—Hodgkin's disease consists of a hyperplasia of the lymphatic glands, associated with anemia and occasional lymphoid growths in the liver, spleen, and other organs.

Causes.—The etiology is obscure; it is a disease of early life, and is more prevalent in males than in females. Among those diseases which are supposed to bear a predisposing influence syphilis, tuberculosis, malaria, and rachitis may be mentioned.

Pathologic Anatomy.—There is no pathologic lesion that distinguishes Hodgkin's disease from leukocythemia save the absence of leukocytic infiltration so constantly seen in the latter disease. The lymphatic glands in all the structures of the body are affected. In some instances one solitary gland, or different groups of glands, may show intense hypertrophy. Occasionally secondary infection supervenes and suppuration results. The spleen, liver, and kidneys are commonly enlarged, the spleen being especially so. The bone-marrow shows degenerative changes and evidences of lymphatic tissue formations are to be seen.

Blood.—The blood shows, in the first stage of the disease, no appreciable change unless it be a diminution of the red cells. When the case becomes markedly anemic, the blood count may fall to 2,000,000, and if the anemia should continue severe, nucleated red cells are found. The white corpuscles are not increased; they may be normal, a little under, or rarely a little over, and should any inflammatory action occur in the glands, they are, of course, increased, and the multinucleated cells predominate. The hemoglobin is decreased out of proportion to the decrease of the red cells.

Symptoms.—A slowly developing anemia is the attending phenomenon marking the progress of Hodgkin's disease. The patient complains of headache from the onset; vertigo and palpitation are rarely absent, and a gradual increase of weakness marks the progress of the malady. The symptom of chief importance clinically is the enlargement of the lymphatic glands and of the spleen. As before stated, any group of lymphatics may be affected, but the submaxillary and cervical glands are most commonly involved. In many instances hypertrophy of

the glands on one side of the neck, followed by the involvement of those on the other side, usually marks the beginning of an attack. Hemorrhages are common, and small patches of ecchymosis are scattered here and there over the entire surface of the body. There is usually slight fever, but it is decidedly irregular and is inclined to be paroxysmal. At times there is considerable edema beneath the eyes and around the ankles, bearing evidence of cardiac insufficiency. The bowels, as a rule, are constipated, and although the stomach is at first retentive, nausea and vomiting may later occur.

Diagnosis.—Distinction must be made between pseudoleukemia and enlarged tuberculous glands. The negative results of blood examination and a tendency of the gland to soften and break down will point to the presence of tubercular disease. Much difficulty is often experienced in distinguishing malignant tumors (lymphosarcoma). The diagnosis can not always be made, but in many cases the recognition of the slower and more irregular growth of the tumor and the involvement of the superficial tissues will point toward malignant disease.

Prognosis.—The chances for the arrest of pseudoleukemia are exceedingly meager, and the outlook is most unfavorable.

Treatment.—Here, again, as in the treatment of pernicious anemia, arsenic has been found to do the most good. Hygienic treatment should never be neglected, and much benefit is often effected by the removal of the patient to new surroundings. Iron, phosphorus, cod-liver oil, and strychnin have been used with benefit in the treatment of the disease. Preparations of the glandular substances have a valuable place here: Phosphoalbumin, bone-marrow in fluid form, or tabloids. These last should be gradually increased to do the most good. Local applications to the affected glands may be practised, and in many cases do good, temporarily at least. Surgical interference by the removal of the diseased glands, although allowable in the early stages of the disease, has thus far given negative results.

SECONDARY ANEMIA.

For purposes of classification this term is applied to those conditions of blood poverty not cytogenic in origin.

The red cells are diminished in severe cases and may fall to a very low figure. A low blood count, however, is very rare. The cells may be paler than normal, may contain nucleated cells (normoblasts and, very rarely, megaloblasts), or may be reduced in size. The hemoglobin is decreased, but not constantly. Some-

times its decrease is more marked than the decrease of the red corpuscles would indicate. The leukocytes are usually increased in number; they may be normal and very rarely decreased, depending upon the condition to which this anemia is secondary. When there is a leukocytosis, it is due to an increase in the neutrophiles.

In malignant disease a very severe leukocytosis is found at times. Sarcoma in childhood is an exception, the average leukocytosis in this disease being about 16,000. The red cells show no changes except late in the disease. After any hemorrhage there is a change in the blood depending upon the amount of blood lost and the character of the case. Soon after the hemorrhage has taken place and a drop of blood is withdrawn, the number of red blood-corpuscles in the individual specimen does not show a material decrease, for at this time there is only a diminution in the quantity of the blood, but as soon as serum has been withdrawn from the tissues to attempt to make up the blood volume, we find a diminution of the red cells to a cubic millimeter on account of the dilution of the blood. The hemoglobin, too, decreases. Changes in the red cells are a diminution in size, color, occasionally poikilocytosis, and a nucleation of the red cells. There is marked increase of white cells, the neutrophiles predominating. The blood presents no characteristic changes, if any, in hemorrhagic diseases; in hemophilia the blood withstands the effects of hemorrhages better than in other conditions. In scurvy there is a diminution of red corpuscles and a decrease of hemoglobin out of proportion to the decrease in the red cells, and a moderate increase of leukocytes. In advanced cases there may be nucleated red cells, polychromatophilia, and poikilocytosis.

Symptoms.—The characteristic pallor of the skin and mucous membranes will give evidence of the patient's general condition. The pulse is soft, full, and rapid. Hemic murmurs are often present, and may be heard in the vessels of the neck and at the base of the heart. The heart is frequently enlarged, later becoming dilated. Palpitation is constantly present and in cases of even moderate severity. Pulsation of the cervical vessels is often seen. Edema of the feet, especially at the latter end of the day or at night, may occur. The skin is harsh and dry, but at times perspiration has been observed. In severe cases febrile paroxysms and ecchymoses occasionally arise, and attacks of syncope give evidence of the deficiencies in the cerebral circulation. Very frequently the hands and feet are cold; vertigo and ringing in the ears may be present as evidences of marked circulatory distur-

bance. The digestion is weak and the appetite capricious. In some cases there may occur respiratory changes, the breathing becoming hard. A resonant dry cough constitutes a troublesome feature. Among the nervous symptoms of this condition headache, disturbed sleep, and neuralgic pain are those most commonly complained of. Emaciation is more or less marked, and the patient seems or feels depressed. There is a general lack of vitality, this finding expression in the whole appearance of the patient.

Prognosis.—The prognosis depends upon the cause. Symptomatic anemia is generally amenable to treatment, save in cases of tuberculosis and neoplasm. When syncope is frequent and prolonged, the outlook is not so promising.

Diagnosis.—It is often difficult to separate symptomatic from essential anemia. A careful inquiry into the patient's general history and a thorough microscopic examination of the blood will aid us in this differentiation.

Treatment.—The original source of the anemia must be sought for and treated. In children the regulation of the diet and care of the intestinal tract often work miracles, for upon these most anemias depend. The anemia following hemorrhage requires prompt and energetic measures. Cardiac stimulants, such as ammonia, strychnin, alcohol, and camphor, must be used. To maintain the blood pressure where the depletion has been great, intravenous or subdermal injections or rectal irrigations are invaluable. For intravenous injections Osler recommends the use of the following :

Distilled water,	1000 parts
Sodium chlorid,	5 parts
Sodium hydroxid,	1 part
Sodium sulphate,	25 parts.

This should be given to the patient in a horizontal position, the head being low and the limbs bandaged. Other diseases must be treated according to the various indications. For the existing anemia a soluble form of iron should be given internally and arsenic may be used in combination with advantage. Above all, open air, sunlight, and a good supply of digestible food are essential in any plan of treatment.

Tubercular Diseases.—In tubercular disease there is no increase in the white cells. This seems to be true of all forms of tuberculosis, at any rate for a time. A leukocytosis appears when cavity formation occurs in the lungs, but not with a simple tuber-

cular deposit. So long as tubercular glands and tubercular deposits are simple—that is, there is no mixed infection—no leukocytosis is found, but when the infections become mixed, it will at once appear. Cases of tubercular meningitis have of late been reported in which leukocytosis has been found, though it is possible that some other element may have entered into the condition. Rotch reports an increase of white cells in a child dying of miliary tuberculosis. The red cells are affected according to the degree of anemia.

Inherited syphilis presents a diminution of red cells and a marked leukocytosis. *Rickets* or *rachitis* presents the same condition.

The Blood as a Guide in the Diagnosis of Appendicitis.—The examination of the blood is of vast importance in the diagnosis as well as in the treatment of appendicitis. Following the well-known relationship of infection, pus-formation, and leukocytosis, the accompanying facts will be found of practical value. In simple catarrhal appendicitis the increase of the white cells is slight. Should there be an increasing leukocytosis during the course of the disease, it would be safe to assume that the germs had penetrated into the body of the organ, and that the peritoneal side of the appendix was becoming involved, and pus was forming, demanding operative procedures. With perforation of the appendix and in the fulminating type there is marked leukocytosis.

The blood count is useful as an indication for treatment, and the presence of a leukocytosis with pain and tenderness in the right iliac fossa and rigid abdominal muscles should always demand an immediate operation, and a case showing no leukocytosis could more safely be postponed until after the acute stage might pass. Watching it carefully, however, by daily blood counts, would keep us safely posted.

Blood in Pneumonia.—In pneumonia the blood presents a large amount of fibrin. There are no special changes in the red blood-corpuscles, nor is there a very pronounced anemia after the disease has run its course. The leukocytosis of pneumonia has been very carefully studied, and the following facts ascertained: if the infection be mild and the patient strong, it is slight; if severe and the patient reacts faintly, there is no leukocytosis and the result is fatal; with a severe infection and a vigorous reaction the leukocytosis is very marked and the prognosis is guardedly favorable.

The following table, prepared by Caspar Sharpless, will assist in the differentiation of diseases:

Disease.	Leukocytosis.	Lymphocytes.	Neutrophiles.	Red Cells.	Hemoglobin.
Typhoid fever, . .	Absent	Relatively increased	Decreased	Decreased	Proportionately decreased
Typhoid with complications, . . .	Present		Increased	Decreased	Proportionately decreased
Scarlet fever . . .	Present	Decreased	Increased	Decreased	Proportionately decreased
Measles, ...	Absent			No change	No change
Smallpox, ...	Marked on third day		Increased	Much decreased	Proportionately decreased
Erysipelas, ...	Marked		Increased	Decreased	Proportionately decreased
Diphtheria, ...	"	Rarely increased	Increased	Slight decrease	Proportionately decreased
Influenza, ...	No change			No change	No change
Typhus fever, . . .	" "			" "	" "
Follicular tonsillitis,	Moderate			" "	
Acute rheumatism, .	"		Increased	Markedly decreased	Markedly decreased
Septicemia, ...	Marked		Increased	Markedly decreased	Proportionately decreased
Abscess, ...	"		Increased	Decreased	Proportionately decreased
Meningitis, ...	"		Increased	Slightly decreased	Proportionately decreased
Peritonitis, ...	"		Increased	Slightly decreased	Proportionately decreased
Pericarditis, ...	"		Increased	Slightly decreased	Proportionately decreased
Pleurisy, ...	"		Increased	Slightly decreased	Proportionately decreased
Malaria, ...	Absent	Relatively increased	Decreased	Decreased	Proportionately decreased
Pneumonia	Marked	Decreased	Increased	Decreased	Proportionately decreased

In pneumonia there is a decrease of the eosinophiles and in scarlet fever an increase.

CHAPTER XI.

CONSTITUTIONAL DISEASES.

RHEUMATIC FEVER.

Synonyms.—ACUTE RHEUMATISM; ACUTE ARTICULAR RHEUMATISM; INFLAMMATORY RHEUMATISM.

Acute rheumatism, or rheumatic fever, is an acute infectious but noncontagious disease, depending upon some unknown infective agency, and characterized by a wide-spread inflammation of the joints with a peculiar tendency to affect the heart. In children the serous membranes are more likely to become involved than the articulations. As seen in early life it is usually subacute.

Causes.—The cause of rheumatism is not yet understood, but is explained by one of three theories: (1) That it depends upon a morbid entity, the result of defective assimilation, the product of which is lactic acid, or certain combinations of it; (2) the nervous theory, according to which either the nerve centers are primarily affected by cold and the local lesions are atrophic in character, or that this nervous disturbance brings about hurtful metabolism, so that the nitrogenous products, instead of being converted into urea, are transformed into uric acid and other poisonous products which cause the symptoms; (3) the germ theory, claiming a specific microbe as the cause of the joint inflammation, the analogy of which is well marked in the septic processes, gonorrhea, and scarlet fever.* Heredity has an important relationship to cause in two-thirds of the cases. Whatever be the poison, it has a selective tendency for fibrous and serous tissues. The immediate cause is rapid cooling of the surface, in most instances, or changes in the weather beyond our ordinary means of recognition. It is essentially a disorder of

* Various observers have recently studied the subject, notably Herman Sahli, Leyden, Achalme, Riva, Triboulet and Coyon, Singer, Jaccoud, and others. Achalme's bacillus, an anaërobic, more or less motile rod, like the anthrax bacillus, is shown to produce symptoms of rheumatism.

young people and relatively common in children, although many of the cases described in infancy belong to a different affection, the arthritis of sucklings. In the young a potent cause is predisposition or inheritance. The inheritance is frequently from a gouty parent. Children under five years are readily affected, and instances are recorded in babes of one and two years. By far the larger number of cases arise in the spring, and one attack predisposes to another.

Tonsillitis often occurs as a precursor to rheumatism or acute arthritis, and it is undoubtedly occasionally followed by acute endocarditis. Packard regards these cases of endocardial inflammation which follow tonsillitis as cases of irritation of serous surfaces by germs or their toxins entering the circulation from the inflamed tonsils. Acute rheumatism may not be due to any one specific organism, but rather a form of septic intoxication or septic infection due to the absorption of the products of several species of micro-organisms or the absorption of the germs themselves in some cases.

Morbid Anatomy.—The synovial membranes of the joints and ligaments become injected, and effusion of a turbid fluid takes place into them and the surrounding tissues. Minute hemorrhages into the membranes are seen. The cartilages of the joints are roughened and swollen, but rarely suppurate. A nodular periostitis has been described. The blood shows diminution of the red blood-corpuscles and an excess of fibrin. Into both the endocardium and pericardium inflammatory lesions may arise, with much plastic exudation. Fibrinous coagula are found in the heart and great vessels. Secondary inflammations, such as pericarditis and pneumonia, are often noticed. Pleurisy, with or without effusion, frequently occurs.

It has been shown, both from clinical symptoms and morbid anatomy, that the essential structures of the heart may be seriously and permanently altered by disease of rheumatic origin without evidence being found of painful states.

Symptoms.—In children the joint affection is less marked than in adults and is limited to fewer articulations. When present, it generally involves the ankles and wrists, and there is more likely to be tenderness rather than swelling. Tender, painful, or stiff joints in children should lead to a study of the temperature and the urine. The fever does not continue long or reach a very high degree. Delirium is uncommon. Should the fever become very great or prolonged, delirium may be present, and pericarditis should be suspected. The urine is concentrated, highly colored, and scanty, the skin moist, but rarely

is there such profuse sweating as in adults. The greatest danger is due to heart involvement, which is much more frequent than in older folk. Endocarditis is the commonest, and arises in the majority of cases—if not in the first, then in later attacks. The symptoms of this complication are disturbances of breathing, a slight cough, possibly pain or discomfort in the region of the heart, and finally a murmur is heard, generally at or near the apex, occurring with the systole. An accentuated second sound may follow the mitral murmur, or occasionally is heard in the aorta. More rarely there is a diastolic aortic murmur or a diastolic or presystolic mitral murmur. The impulse is more or less increased in force and extent, but it is very difficult to ascertain whether there is increased dullness on percussion. The pulse is seldom regular, and usually of higher tension than normal. Congestive states of the lung are liable to arise, slight dullness being elicited, and fine rales may be heard, and along with these signs of increasing irregularities of the circulation. Ulcerative endocarditis, when it occurs, is ushered in by chills, high temperature, and profuse sweats. The danger arises here of the detachment of vegetations, which, carried into the vessels of the brain or elsewhere, produce cerebral plugging or other embolic troubles. The first sound of the heart may become merely muffled or impaired enough to cause anxiety and finally pass away. This may be due merely to hyperemia altering the heart-sounds, which subsides with the systemic inflammation. It must ever be conscientiously borne in mind that in spite of all recognizable adventitious heart-sounds an endocarditis can be present during the progress of rheumatism, with or without painful states, working serious damage, or at any moment latent disturbances may become apparent. The temperature ranges from about 101° to 101.5° F. (38.3° to 38.5° C.).

Pericarditis is not so common in children as in adults, and is rare under seven years of age. The existence of this is more difficult of recognition than the endocardial lesions, though they may coexist. The symptoms of a beginning pericarditis are most varied in character and degree. They may be so trivial as to pass unnoticed, or cause horrible distress. The pain and severe dyspnea are probably the result of the involvement of the superpericardial nerves, as has been demonstrated by Sansom. This author also says there is a swollen heart in rheumatism which is not due to pericarditis, but to congestion and infiltration of the whole heart muscle, and that this is not a myocarditis. The symptoms are those of endocarditis, with an exaggeration of the distress and dyspnea, more evidences of nervous perturbation,

more fever, and more pain about the heart. It is much less easy to outline cardiac dullness in children than in adults, and very often this is of irregular shape. Auscultatory percussion, with or without the phonendoscope, makes this more exact. The form common in children is a dry pericarditis, or, at least, the effusion is not usually great. Friction sounds may be heard. Sometimes this complication precedes the arthritis, but it may occur in any stage of rheumatism, and is liable to show itself anew as different joints become affected. Sir R. D. Powell is of the opinion that the more dangerous heart lesions, mitral stenosis and aortic regurgitation, rarely occur in primary attacks, but are the results of slow deforming valvulitis. Pneumonia is an uncommon complication, and when present, is not so much shown by cough and expectoration as by localized dullness and sudden increase of temperature. Pleurisy, single or double, is of frequent occurrence. When single, it is liable to be of the left side and thus imperil the pericardium. Chorea, which is very closely allied to rheumatism in childhood, generally shows itself, if at all, toward the end of an attack, upon the subsidence of the more acute symptoms. Chorea may begin at the height of the rheumatic process, and when it does, there has probably been a beginning of cardiac involvement, and it is most likely to arise in nervous, emotional children. Rheumatic children are frequently attacked with an acute tonsillitis, appearing much like diphtheria or the throat inflammation of scarlatina or influenza. This pharyngitis may be the first symptom of rheumatism, or it may occur in its course, and is rarely followed by suppuration or ulceration. Fibrous nodules to be found about the joints are sometimes described by foreign authors; these are tender on pressure, about the size of a shot or a pea, recognized by touch, and occasionally insensitive. These have some relation to endocarditis, and, where frequently occurring, are said to be an index of cardiac involvement. A common sequel of rheumatism is anemia, which may be very marked and persistent. Successive rheumatic attacks induce blood dyscrasia, a lowering of all the vital forces, shown in peevishness and general discomfort. The evil effect of rheumatism on the blood resembles that of the malarial poison. Certain diseases are definitely connected with the rheumatic diathesis, as erythema of the various forms and purpura. Muscular rheumatism is also seen in children, especially in the form of torticollis.

Diagnosis.—In the rheumatism of children, as has been pointed out, arthritis is relatively mild, the cardiac symptoms most severe; the joints may present little more than a stiffening, with tenderness upon pressure or upon active or passive move-

ment. In them acid sweats and pyrexia are less prominent; the hemorrhage and vasomotor phenomena, purpura, erythema, also pleurisy are more in evidence. In children various phases of rheumatism may arise independent of one another. The diagnosis will need corroboration by estimating family tendencies, such as recurring attacks of tonsillitis or a history of rheumatic seizures. If the heart be found affected or the characteristic nodules or erythema be seen, or a history is furnished of antecedent chorea, along with multiple painful involvement of the joints, fever, and sweating, then we may be sure of our diagnosis. The heart must be watched unceasingly, and often gives little evidence of a growing damage. The symptoms of scarlatinal arthritis are so like those of rheumatism as to be indistinguishable from it unless there be some guiding symptoms.

In epidemic cerebrospinal meningitis the joints sometimes become so tender as to be mistaken for acute rheumatism. Violent headache, spasm of the neck muscles, the spots common in cerebrospinal fever, will act as sufficient differentiation. There are many conditions arising in children, accompanied by tenderness of the joints, which should be borne in mind; among these are pyemia, scurvy, the tender joints of rickets, some conditions of syphilis, scrofulous arthritis, and the pyemic arthritis of infants.

Course and Duration.—The complications of rheumatic fever in children influence largely its progress and curability. The duration varies from ten days to three weeks in the well-established cases, and may be marked even then with fresh outbreaks of varying severity. If treatment is instituted at once and absolute rest maintained, a much earlier recovery may be expected. If the heart becomes affected, the course of the malady is prolonged. A dangerous condition, especially to the heart, is a series of subacute attacks, following upon one another, while the joints are little disturbed. Cases in very young children have been reported where recovery took place in a few days.

Prognosis.—The danger of rheumatism depends rather upon cardiac implication than upon the fever itself. When attacks are frequently repeated, this is likely to occur and grow worse with each outbreak. In rare instances the heart may escape after many attacks. It is extremely difficult to estimate the amount of cardiac mischief that remains after the acute symptoms have subsided. A mere roughening of the valve may disappear after a few months, but is likely to remain and give evidence by hypertrophy with dilatation. This is especially to be feared with slight recurrences of rheumatism, and above all should a sharp attack arise. Few cases of endocarditis are unaccompanied by

involvement of the pericardium also. Pericarditis may occur by itself, and from it recovery is more hopeful. The hypertrophy or dilatation is established more readily in children than in adults, and increases at a higher rate. The appearance of fibrous nodules is a danger-signal. Marked anemia following heart disturbance is a grave feature.

Treatment.—Immediately on the appearance of rheumatism the child must be put to bed and clothed in woolen or silken garments, and lie between soft, thin blankets. If the fever be high and the sweat not profuse, it is not well to keep the room very hot, but it should be dry. No movements should be allowed, and the earlier medication directed to the securing of tranquillity. If pain be not very great, this is difficult, but is most essential. The bowels must be promptly relieved by a saline or other laxative. All dejecta must be passed into the bed-pan, which should be well warmed; the upright posture can under no circumstances be allowed until all danger is quite gone.

No definite amusement should be supplied; monotony is best, and children will more readily submit to this than adults. The tender joints require protection at all times, and among the best is simple cotton-wool kept in place by a few light turns of a bandage. If these parts are very painful, wet applications, such as solutions of bicarbonate of soda and laudanum or salicylate of methyl or witch-hazel, may relieve them. The fixation of the limbs by means of light splints, such as light but stiff pieces of cardboard, either straight or molded to fit, is very comforting. Cold applications will relieve heat and pain—ice or iced water, frequently changed. Nervous or anemic children prefer hot and dry applications. To the water thus applied various substances may be added, such as chloroform water or mint water, or these together with a little carbolic acid and bicarbonate of soda. The blood in rheumatism has less than its normal alkalinity, or, as has been practically demonstrated, becomes actually acid. This, then, warrants the use of alkaline salts throughout the course of the disease, no matter what other medicaments are used; it also is necessary to consider defective elimination from the blood. The remedies of most use are those which exert a preservative or antiseptic action on the tissues (Foster)—methyl salicylate, potassium iodid, potassium bicarbonate, iron chlorid, quinin, etc.

All medicines, moreover, should be in large dilution and the patient be encouraged to drink freely of the natural alkaline waters, such as Seltzer and Vichy. The use of internal medicines for the rheumatic fever is not very satisfactory. The compounds of salicylic acid are of value to relieve pain, but can not

be shown materially to shorten the disease or prevent endocarditis. The salicylate of sodium is the best for its antirheumatic and antipyretic action, but it often disturbs the stomach. The salicylate of ammonium is useful along with the liquor ammonii acetatis. The salicylate of strontium and of cinchonidin has been lauded by some, as has also the salicylate of lithium—this last more particularly for the subacute varieties. Cheadle prefers salicin alone or with sodium or potassium citrate. Sansom continues the salicylates from three to six weeks, and gives along with this preparations of ammonia—the carbonate or the aromatic spirits of ammonia. The salicylates should be given in full doses of from three to fifteen grains, every four hours, for three or four days, when, if they have failed to relieve, they are of little more use; if they have relieved, at the end of this time they may be lessened one-half for, perhaps, a week longer. Failing relief from these, we may succeed with a cautious dose or two of coal-tar antipyretics, which are liable to depress the heart, and it is well to guard them with a little strychnin, digitalis, or strophanthus. It is useful to combine the iodids of potassium or sodium with either of the foregoing group, especially after the first few days. If the fever runs high and a failure of respiratory vigor, delirium, or other cerebral symptoms appears, prompt and vigorous antipyresis should be employed; here the cool (80° F. —26.7° C.) or cold (60° to 50° F.—15.6° to 10° C.) pack is valuable, with a few well-directed doses of acetanilid or antipyrin, carefully watched. To secure tranquillity of mind and body the bromids are useful, though depressing: especially useful are the bromids of lithium, sodium, or strontium. Few things are better here than small doses of opium, such as the elixir of McMunn, Dover's powder, or codein, especially if cerebral involvement be suspected. Quinin or the salicylate of cinchonidin sometimes acts most happily as an auxiliary measure, especially when the temperature attempts to run high, which is likely to be the case where there is endocarditis or pericarditis. Five to eight grains a day should be given to a child five years old. For the heart complications full doses of opium with or without brandy or whisky are recommended by DaCosta, Powell, and Cheadle. When exudations arise, as in the pleura or pericardium, the iodids are especially valuable. For imminent heart failure, shown by a feeble first sound, small and irregular pulse, the hypodermic use of strychnin with brandy and digitalis is urged by Cheadle. It is well to avoid the use of syrups as menstrua, because of their tendency to produce acid in the stomach, and use rather a few drops of compound tincture of

cardamom, which, with the alkalies, make a sweetish mixture, with or without a little glycerin. Simple elixir or essence of pepsin also answers very nicely.

Preventive treatment is exceedingly important and has large possibilities. Children of rheumatic parents, or who have had threatenings or mild attacks, should have the utmost attention given to the hygiene of their skin, and become accustomed to regular cool or cold bathings. Nothing is more valuable than this; after the bath the skin should be thoroughly rubbed, and, if not too tender, with a fairly rough towel, or a towel dipped in brine, rough dried, and kept for the purpose. If the skin be a leaky one, a little diluted alcohol, or spirits of camphor or aromatic vinegar, may be applied. The skin must be promptly protected by clothing immediately after the bath and at all other times. After exercise or overheating, children susceptible to rheumatic attacks should be dry rubbed in a warm room and redressed. All growing pains or joint tenderness must be watched sedulously and considered. Such children should never be too warmly clothed, except possibly as to their underwear, and should never be allowed to have their knees, shoulders, or arms left bare or their feet carelessly wetted. Indeed, it is distinctly important for children susceptible to rheumatism to live in a dry climate, certainly in winter.

The diet is of importance and had better be nitrogenous, and not include too much of starch. Milk is the best food. General tonics are needed for the repair of the blood dyscrasia, especially iron and cod-liver oil.

Gonorrheal articular rheumatism is rare in children, but when it does occur, it is mostly confined to one or a few joints. The effusion may be large and become purulent. This must be promptly treated to save the joint and to protect from pyemic infection. The treatment is surgical—an aseptic opening of the synovial cavity, the pus removed, the cavity washed out, and the limb put on a splint. Quinin enjoys a well-earned reputation to control pain and limit extension.

Muscular Rheumatism.

Muscular rheumatism occurs in children of from five to fifteen years of age. It often follows exposure to wet or drafts, and especially when to these is added fatigue. Indiscretions in diet followed by constipation may in older children be a not infrequent cause. The exciting causes are: constipation, improper clothing, especially shoes that are too thin, any underclothes or socks

other than wool, warm and damp weather, imprudences in diet, depressing conditions generally, overfatigue, and loss of sleep. The parts of the body most usually attacked are the shoulders, neck, and back, and the pain is pronounced on movement. There is little constitutional disturbance or heart involvement. Muscular rheumatism is likely to be confounded with neuralgia, and may take the form of head pain. The urine is generally highly colored and loaded with urates. The best treatment is prevention, cold baths, and care of the skin generally, along with suitable clothes. In acute attacks Dover's powder acts most promptly, or atropin hypodermically, followed by saline diuretics. Extreme dry or wet heat, iodin, methyl salicylate, galvanism, also rubefacients, are efficacious. Nothing will drive away the stiffness so quickly as a dry rub with a coarse towel or warm sweet oil, with or without a counterirritant like turpentine or chloroform liniment, the rubbing to be continued fifteen to twenty minutes and followed by the application of dry heat, as hot as can be borne. The most convenient agent is the kitchen flat-iron well heated and applied over a thin flannel garment, slowly moved about the affected and adjoining areas. A hot-water bag is useful but far less efficacious. The most satisfactory treatment of chronic muscular rheumatism is a strict regimen, consisting of proper woolen clothing, active exercise in the open air, such as bicycle riding, tennis, etc., until the patient is in a glow, or, better, a sweat, and before any chill can have taken place go at once to a dry room in which the temperature is not below 65° F. (18.3° C.), and with the extremities still protected, rub the chest, back, and limbs until the skin is dry.

Chronic Rheumatism.

Chronic rheumatism is very rare in children, but recurring short attacks of a rheumatic nature, with stiffness and pain, are met with. This requires persistent hygienic measures, along with massage, the application or rubbing in of ointments, such as ten grains of iodin, twenty of extract of belladonna, to the ounce of lanolin. Cod-liver oil is almost a specific.

Rheumatic Phlebitis.

Rheumatic phlebitis is rare in children. According to Schmitt and Virchow, the initial lesion is found in the endothelial lining of the veins, and the inflammation spreads gradually until it reaches the outer layers of their walls. Periphlebitis is rare in

rheumatic cases. The ultimate cause of the phlebitis is probably due to the presence of a parasite in the blood, but we are as yet unable to prove this theory. The most prominent symptoms of rheumatic phlebitis are a sudden rise of temperature, pain, and the presence of a thickened cord on palpation. The pain is due to acute degeneration of the nerves supplying the lining of the vein. To feel the indurated vein, careful palpation is necessary sometimes, as the vein may be situated deeply. Edema is a later symptom, and its intensity is in proportion to the size of the infected vessel. If the edema persists for some time, there may be complications in the form of ecchymoses, vesicles, and even gangrene of the skin. The edema is due to the action of the toxins produced by the bacterium which is responsible for the thrombosis.

Rheumatic phlebitis may occur during an attack of articular inflammation, or during convalescence from such an attack. It is most frequently found in the lower extremities, and in such cases is almost always curable. In other cases it occurs in the upper extremity, and is almost always fatal. The occurrence of pulmonary emboli can be prevented by immobolizing the limb on a wooden trough well padded with cotton and placed on several pillows to favor return circulation. The pain may be relieved by means of anodyne liniments. Against the edema, which appears later, the best measure is compression of the limb by means of a bandage, which must be applied over a layer of cotton. The atrophy which follows in these cases may be treated by baths, which should be luke-warm at first, then hot, and followed by a short treatment with massage; salt baths and a sojourn at one of the seaside resorts are of value in convalescence.

RACHITIS.

Rachitis, or rickets, is a disorder of nutrition primarily, but so numerous and characteristic are the attending disturbances of the nervous system that it may be regarded as secondarily a neurosis. Rachitis is a complex constitutional disorder of childhood, occurring between the ages of six months and two years, characterized chiefly by evidences of defective nutrition affecting all the structures, but more conspicuously the bones, and a lack of tone in the ligaments, causing bow-legs, knock-knees, flat-foot, and weakness of the muscles. It is distinctly a preventable disease.

Along with these phenomena are frequently seen profound nervous symptoms, craniotabes, with its resulting hyperemia, and

other cerebral disorders, insomnia due to this, night-terrors, irritability of temper, at times rising into maniacal attacks; laryngismus stridulus, convulsions, hydrocephalus, tetany, with Trousseau's symptom, spasmus nutans (nodding or rotary spasm), nystagmus, and hyperhidrosis. These states all may be entirely recovered from, and usually with no resultant cerebral damage. Digestion is also seriously deteriorated; there is a marked tendency to intestinal and other catarrhs, anemias, and vitiation of the blood.

Rachitis is a far more common condition than statistics would lead us to believe. It often disappears spontaneously under favorable circumstances or changed conditions from those which produced it. It is at the foundation of much of the impaired resistance in infancy and early childhood. When the active process ceases and only the deformities remain, the individuals are oftentimes most vigorous, both physically and intellectually.

Causes.—Rachitis is found the world over, chiefly in cities or in crowded, underfed communities lacking light and air, and is rare in country-places or where the food-supply and hygienic conditions are favorable. It is more common in Europe than in America, and our supply of cases of the disease is derived mainly from there. It is shown by Morse and others to be on the increase in this country. Observers in the large clinics of Europe admit its appearance in over 30 per cent. of children applying for advice. In this country it is not quite so common or severe, even in our largest cities, and is comparatively rare out of crowded centers unless brought thence. With us in America it is seen either in the children of emigrants or in the negro and mixed races, often in babies who have been hand-fed or who early get coarse or unsuitable food, particularly when this is deficient in fat. Snow has called attention to the fact that here it is most noticeable in the transplanting of a southern race to a northern climate. It appears now and again in the families of the well-to-do, even among the rich, especially where nervous mothers coddle their children overmuch or practice erroneous methods of feeding and nursery hygiene, above all if enough air and sunlight are denied them. Rickets is rarely congenital. The disease usually develops between the first and second years, but may develop in utero.

Predisposition has much to do with the production of rickets. The offspring of parents in feeble health, overworked and underfed, with poor digestion and assimilation, a senile father or a mother from any cause exhausted, as by prolonged lactation, discharges of pus or blood, etc., is apt to be rachitic. Rachitis

is not distinctly hereditary, although at times it has the appearance of being so.

Parental syphilis, alcoholism, and tuberculosis frequently induce rachitis. Infants who begin life with an unfavorable inheritance, and who are confined in dark, filthy, overcrowded houses, especially in damp cellars, are very prone to develop the disease; even those who begin with good constitutions may thus become rachitic. The most powerful factor is food deficient in certain essential qualities, as fat and albuminoids. Breast-fed infants usually escape, but not always, and those who depend upon breast milk from poorly nourished mothers or upon the parental supply for too long a time are liable to the disease. Even where the supply of food is good and yet the digestion is too weak to cope with it, infants may thus be affected. Those infants who have been fed on the proprietary foods are especially prone to this disorder. If the strength be reduced by any cause, such as summer diarrheas, rachitis may begin without any intervening stage (Eustace Smith). Rickets is a frequent sequel of exhausting infantile disorders, especially in one predisposed.

General Symptoms of Rachitis.—The first symptoms of rickets in a child are fretfulness, disturbed, intermittent sleep, and slight fever at night. The little patient becomes mildly cross, repelling advances, its pillow becomes wet with sweat during sleep, beads of perspiration appearing first on the forehead and face. It seems to suffer from a sensation of heat or oppression, and kicks and throws off the bedclothes, inducing a peril from chilling of the areas thus exposed, especially as the surface is usually abnormally damp and the skin relaxed. There is always marked pallor, and often a diffuse soreness and tenderness of the body. The indisposition on the part of the little sufferer to be moved, however, is not due to the tenderness of the joints, unless scurvy be present, but rather on account of the respiratory distress induced. The digestion is markedly disturbed by flatulence, fetid stools, and diarrhea, with evidences of intestinal catarrh. The appetite is often ravenous, especially for meat and fatty substances. The digestion is slow, however, and imperfect, and food is passed undigested, the stools having a most abominable odor, often curdy-looking and surrounded with mucus. The liver and spleen are often enlarged, and dentition is delayed. The spleen is palpable, or definitely enlarged in over half the cases, or, according to Starck, in 68 per cent. The enlargement of the spleen corresponds with the degree of anemia present. This condition is not a part of the process, but probably due to toxins produced by the rachitic

condition. The veins about the head are seen to be large and full. On being touched, the child shrinks away or cries; the flesh is sore, but this is probably due to a morbid state of the periosteum or cartilaginous junctures, though not entirely, because the abdomen is also tender. The child is comfortable only when lying quietly or held carefully in the arms. In some there is a slight temperature-rise in the latter part of the day, and a moderate quickening of the pulse. After a time changes in the skeleton occur, first to be felt and later to be seen. Craniotabes, or thinning of the occipital bones in spots, is a very characteristic deformity, occurring during the first year, usually before the tenth month. This is a source of considerable peril, because of leaving areas of the brain undefended by proper mechanical protection. The condition is often ascribed to a double infection of syphilis and rickets acting together. Such a child is more than ordinarily fretful, especially when lying down, because in this position pressure is exerted almost directly on exposed areas of the brain. Cerebral circulation is thus disturbed, hence sleep is unquiet, the child awakens readily, and needs to have its position altered. This possibility of varying pressure may produce considerable disturbance of the vasomotor and cardiac centers in the medulla. Many slight changes are thus produced in the brain, oftentimes but temporary, exaggerating the well-known susceptibility of rachitic infants to neuroses. Laryngismus stridulus, or glottic spasm, while not common, is a characteristic phenomenon, occurring suddenly with an arrest of respiration, seemingly a palsy of the respiratory center; the face becomes deadly pale, a moderate rigidity of the limbs sets in, with carpopedal spasms. After a few seconds a long, deep, effortful inspiration is made, and this, passing through the narrowed chink of the glottis, causes a whistling sound or cock crow, and the attack ends with a waking-up of the patient in a dazed and surprised condition. Rachitic infants are especially liable to convulsions, also to tetany. These unfortunate children are peculiarly defective in their power of resistance. The altered shape of the chest-wall, which is often a lateral depression of the ribs and thrusting-out of the sternum anteriorly, produces changes in the shape of the organs within. The heart is not seriously affected, but the completeness of its movements is interfered with. The lungs, moreover, can not expand properly, from which may come a host of symptoms due to impaired circulatory and respiratory completeness, of little importance in moderate health, but acting as a source of great danger in disease. A partial collapse of certain lobules of the

lung is likely to occur on slight congestion, especially along their thin edges. The lateral and posterior parts suffer from pressure, and the anterior borders may become emphysematous. If in such an one bronchitis or bronchopneumonia occurs, the elimination of mucopus is difficult and cyanosis of a serious sort readily arises. When coughing occurs in a rachitic child,—and it is a frequent symptom,—it continues in spite of relatively little local irritation and is difficult to allay. A peculiar form of "pressure palsy" is sometimes seen in rachitic children, owing to inflammatory change in the vertebræ compressing the cord, and from this they almost always recover.*

The acute form of rachitis is recognized by a marked febrile movement and greater tenderness than occurs in the usual slow variety and in which the joint swellings appear more quickly.

The change in the bones of the head leaves the fontanel open long after it should have closed (at about eighteen months), and at a year and a half to two years it may be one to two inches wide. The head is usually larger than that of a normal child, and by contrast to the shrunken body seems much larger. The urine usually contains calcareous salts or phosphates.

Deformities.—A child distinctly rachitic is a conspicuous and familiar object in all clinics, and in the practice of all except physicians in very fortunate rural localities. Those in whom the disorder is less graphically marked can yet be readily recognized by a well-defined train of phenomena.

The general appearance of a rachitic child is that of one badly modeled by a novice. Pallor is a constant feature; the blood is low in hemoglobin, below 50 per cent. or less, sometimes there is a leukocytosis, but the red cells are little, if at all, affected. Most rachitic babes are soft and doughy, lacking in tone, with little resistance in any of the fat tissues. As they grow older the lymph-nodes become enlarged and the tonsils hypertrophy, as do also the adenoid tissues about the vault of the pharynx.

The mucous membranes are easily disturbed, both in the respiratory organs and in the intestines and bowels. Digestion is poor, and diarrhea easily induced and difficult to check. Fortunately, the appetite is usually good, especially for fats and flesh meats, so much needed; these articles are readily assimilated.

Catarrhal attacks are liable to run a protracted course and ex-

* One of us reported three instances of rachitic pseudopalsy occurring in a well-to-do family where twenty cases in all had been noted.—"Annals of Gyn. and Ped.," December, 1891.

tend broadly. The nervous disturbances have been alluded to. They are dependent upon defective nutrition of the centers, which in children are in an undifferentiated state, and interference in their proper growth is quickly followed by profound perturbation of function.

Dentition is apt to be very late, slight congestive stages of tooth growth and eruption are enough, in a rachitic child, to act as exciting causes to the very unstable condition of its nervous forces; hence these children suffer extremely from what is usually a normal process.

The order of teething is not changed materially, though it may be very irregular, nor are the teeth themselves defective; this last in sharp contrast to syphilis, which is said by some to be so closely connected with rachitis.

The more graphic phenomena of rachitic children are the deformities, essentially symmetric, first seen in the enlargement of the bony junctures, especially the ribs and the costal cartilages, forming the much-quoted "rosary." This latter is present in nearly all cases and is a valuable diagnostic sign.

An osseous thickening is marked in the center of the parietal bones and the bases of the temporal bones. The development of the bones of the jaw is arrested, especially the upper jaw and malar bones, hence the disproportionate smallness of the face is both apparent and real.

The head appears to be too large and is out of proportion to the body, though not, as a rule, of much greater circumference than a normal head. It is usually square, because of the prominence of the parietal bones, and flattened at the vertex and occiput. Sometimes this is accompanied by a sulcus, or furrow, in the midline, anteroposteriorly, and laterally along the coronal suture. The sutures remain open much longer than in healthy heads. The fontanel is open as late as the end of the third year in some instances.

The chest is frequently deformed by the bending-in of the ribs at the costocartilaginous junctures, lateral depressions over the lower third of the thorax and eversion of the lower borders of the ribs are present. The ensiform cartilage is sometimes markedly depressed, leaving a circular concavity. The cause for this is largely atmospheric pressure from without not being counterbalanced by internal resistance upon the malleable ribs.

This deformity of the chest interferes seriously with the symmetric development of the thoracic and other organs. The aorta has been reported deformed (Jacobi), being bent upon itself, impeding the heart action and circulation. It is because of this

impeded circulation that rachitic children are subject to attacks of dyspnea and bronchitis.

The spleen and liver are commonly enlarged and crowded downward, because of the narrowing of the thorax. The kidneys, too, are often displaced, especially in cases showing much scoliosis and rendering them more liable to nephritis.

The spine is not generally deformed, but kyphosis, or posterior protrusion, is the most common; occasionally there is rotation. The pelvis rarely escapes some distortion, generally a diminution of the anteroposterior diameters. The limbs undergo conspicuous changes in shape from the malleable state of the bones, and slight muscular strains increase these as activity progresses.

Enlargement of the epiphyses is the characteristic feature, commonest at the wrist, sometimes at the elbow. The long bones suffer deformity, particularly of the legs, from the pressure on them while attempts are made at standing. This induces bow-legs and knock-knees, rarely a curve in the femur. While sitting, however, a more marked double curve is given to the lower limbs from the cross-legged attitude long continued. In the early stages of deformity, while the bones are so soft that they can be bent by the hand, braces are of most value. These must reach above the knee, and should be provided with rods placed opposite the points of greatest convexity, and exert continuous pressure. Success varies with the individual case. If the bones can not be remodeled thus, osteotomy is demanded, and the orthopedic surgeon should be consulted early in the case, not only to operate or brace, but critically to watch progress and correct deformities early.

After the third or fourth year braces usually do little good without some form of cutting operation on the bone itself. Many children are too poor to pay for braces, which, to be efficient, must be well made and kept in perfect repair, and plaster-of-Paris bandages may then be used with advantage. The different bones of the same individual vary in density: the leg of one side and the thigh of the other may be soft, while the corresponding bones on the other side may be hard; but this, of course, is not the rule.

For a description of the braces most commonly used the reader is referred to the works on orthopedic surgery, as well as for the details as to the operation of osteotomy. The latter consists in cutting through the femur and straightening the thigh for knock-knees, or through the tibia and fibula for bow-legs. It may be necessary to operate upon both the femur, tibia, and fibula at the same time before the leg is straightened. The bone

may be simply cut through and the leg straightened, or, if the deformity be very great, a wedge-shaped piece may be cut out of the convexity of the bone to insure a good result.

The limb should then be enveloped in cotton, or a plaster-of-Paris bandage applied to keep the limb straight.

In young children, especially, it is sometimes well to suspend the limbs from a frame at right angles to the axis of the body; this insures extension, and at the same time keeps the bandage free from being soiled with the urine and feces. The limb should be kept longer in plaster than for the healing of an ordinary fracture, as the repair of bone is somewhat delayed, owing to the rachitic condition.

Pathology.—While true that the most conspicuous changes are observed in the ends of the long bones and ribs, the morbid anatomy is that of a constitutional disease, a blood dyscrasia, affecting the nutrition of nearly all tissues of the body, thereby producing disease in the osseous system which is closely allied to inflammation. The primary lesion is hyperemia of the periosteum, the marrow, the cartilage, and of the bone itself. The disturbance of the normal growing bone causes changes in the bone already formed. The cartilage cells of the epiphyses consequently undergo increased proliferation from four to eight times more than they do in a normal growing bone. The matrix is softer; as a result, the bone which is formed from this abnormal cartilage lacks firmness and rigidity. The increased proliferation of cells makes the epiphyses larger, swollen in appearance, irregular in outline, and very much softer in consistence. The high vascularity favors the process of absorption in the bones already formed, so that the relation between removal and deposition of lime salts is disturbed, absorptions having taken place more rapidly. It has been experimentally proved that hyperemia of bone causes defective deposition of lime salts. In the parieto-occipital region and in some other cranial areas ossification is retarded, so that the bone readily yields to pressure by the finger (craniotabes). The fontanels are not promptly closed, by reason of delayed ossification. The frontal and parietal protuberances are very much enlarged, due to exaggerated proliferation of the periosteum, so that the head acquires a broad forehead, with characteristic frontal eminence, a condition mistaken for hydrocephalus. When ossification begins to take place the bones become large, heavy, and irregular in outline. These changes correspond to the graphic clinical manifestations—bow-legs, knock-knees, pigeon-breast, spinal curvature, and square cranium. The wrists, ankles, knees, and ribs at points at the junction

of the bone and cartilages become enlarged; on the ribs they occur in a series simulating beads, which is called the "rachitic rosary." The prominent visceral change is the enlargement of the spleen and liver. The splenic enlargement is not a primary but a secondary process, probably due, as has been said, to toxic disturbance the result of some essential process. At first the enlargement is due to an increase in the pulp, later in the connective tissue. Starck found the spleen enlarged in over one-half of the autopsies on rachitic children and in 68 per cent. of living cases.

Prognosis.—The disease is not fatal of itself, but death often readily results in the enfeebled organism from some intercurrent malady. Under proper treatment recovery takes place, with some resulting deformity.

Treatment.—As has been said, we may assume that nearly one-third of all the children of our city population, and perhaps a fourth of others, exhibit the evidence of rickets or may readily acquire the disorder. Therefore, a thorough consideration of detailed treatment can not be out of place. We will review here an outline of such systematized measures as are suitable, and in the chapter on General Considerations on Physical Development the matter will be treated more fully. The first consideration is prevention; here it is necessary to face the question of accepting or rejecting degenerate immigrants—a matter which is probably about to play a very important part in politics.

The next step is to give our attention to pregnant women who are of these devitalized classes and races. If this can be done, much may be accomplished. Bathing, good air, sunlight, and abundant, well-cooked food will accomplish much. A short residence in the country would do more. The relief of the coming mother from exhausting labor and overwrought emotion is also of great value. The result of such care may be a pretty fair child, and upon such a little one continued liberalizing influences will work to great advantage, and a few generations of such measures regenerate a moderately good population. The rachitic baby should be kept in a room which faces the south, whence come the best breezes in summer and sunlight at all times. It should be kept at a temperature in the neighborhood of 70° F. (21.1° C.), with the windows much open, or on sheltered house-tops or piazzas, wearing extra clothing the while. Underwear should be of wool, thin in summer and thicker in winter; bathing should be daily, as much for tonic action as for cleanliness. If the extremities become chilly after this, or at any time, it is easy and valuable to apply external heat. The breast milk of the

mother is always the best, and during lactation she should take tonics and extra food rich in fats and albuminoids. The mothers of the poorer classes fill themselves up on bread and tea while nursing a baby; they had better live on milk and meat. It is important that mothers of babies showing rickets should sacrifice something to the needs of lactation. Good breast milk when insufficient is of little use if supplemented by coarse, ill-cooked "table food." Poor breast milk is better than none, because it can be made better unless the mother be distinctly infected, as by tuberculosis. The natural supply can be supplemented by suitable food better than to depend upon hand-feeding alone. For rachitic babies this extra diet is nearly always necessary, certainly after eight or ten months. The extra food should be cow's milk modified by water, milk, sugar, cream, and an alkali, and possibly some "casein breaker" or attenuant, such as barley or oatmeal water. The milk formulas should first have a low percentage of proteid and a moderately large amount of fat, and later, as the digestion becomes stronger, both these milk elements should be increased. This should alternate with strong animal broths and but little or no starch food. Starch feeding produces rickets in those predisposed. Weaning should not be allowed in the hot months, certainly not in our large cities. In the preparation of milk the first requisite is proper care as soon as it leaves the cow, and this is receiving most gratifying attention at the hands of dairymen.

If the milk be sound and kept so, it need not be subjected to heat to fit it for use. As ordinarily supplied it will require Pasteurization or sterilization; the latter, however, can not be used but for a short time. Simple boiling over a water-bath does fairly well, especially for older children. Prepeptonization is of great use, particularly for one or two meals in a day, and along with supplemental diet.

Properly prepared cereal solutions, as of barley or oatmeal water, are not only cheap and convenient diluents, but of real value to separate particles of casein and prevent lumpy curds in the stomach, and they are in themselves nutritious. They are far better when diastase has been added. The amounts and intervals of feeding are of as much importance as quality. Breast-fed infants of vigorous stock may survive some insufficiency, but the feeble, rachitic infant should receive overfeeding rather than underfeeding. The value of overfeeding or forced feeding in children has not been studied enough except where the food was of bad quality.

It often happens that a very young child, especially a rachitic

one, will greedily devour and thrive notably on a liberal diet of beef and mutton.

Constitutional treatment must be instituted in the first half year or year to be efficient. Little can be expected after the second year, for by that time we have chiefly the effects of the disease, not the disease itself, to deal with.

For the deformed chest, and its resultant cramped lungs, regulated gymnastics are indicated. Rarefied air deserves more extended trials. For kyphosis extension and postural treatment are indorsed, along with prolonged rest in bed.

Medicinal Treatment.—Rachitic children are particularly liable to gastric and intestinal disturbances and weaknesses; their stomachs are usually hyperacid and need alkalies; for the relief of this in the infant pancreatic extract with soda is of use; in older children well-diluted muriatic acid and pepsin are better; also there should be supplied other secretions of the intestines which assist assimilation. Peptenzyme, or similar preparations purporting to contain the active ferment from most of the intestinal glands, has a useful function. It may be well to mention here the malt preparations as being useful if there be no diarrhea, and to be added to starch food or given alone. The great remedy for rickets is cod-liver oil, because of its fat, and not less because of its bile salts, and of less than half its value if these biliary principles are destroyed or injured in the preparation. To cod-liver oil may be added with advantage raw eggs, glycerin, or syrup, and spirits or some heavy-bodied wine or cordial. If we could be sure of getting a cod-liver oil made from fresh livers of fresh codfish, and prepared by cold expression, we would have the best thing obtainable. Some years ago this was forthcoming at the hands of an old sea captain named Stone, of Swampscott, Mass. A favorite preparation of the authors is: Place in an eight-ounce bottle one raw fresh egg; glycerin, ½ of an ounce; maraschino, curacoa, sherry, or port wine, ½ of an ounce; cod-liver oil, six ounces; shake thoroughly, and keep on ice in the dark, and give a dessertspoonful before two principal meals. Russell's emulsion of the mixed fats is of great value. One drug which enjoys a large reputation in overcoming with great promptitude and thoroughness the defects of bone growth in rickets is phosphorus. This should be given in small dose—$\frac{1}{200}$ to $\frac{1}{100}$ of a grain after meals. Iron, manganese, and arsenic are of value for the anemia. To relieve sweating, atropin, picrotoxin, and the cardiac tonics are useful, as well as aromatic sulphuric acid.

SCORBUTUS.

Synonyms.—INFANTILE SCURVY; BARLOW'S DISEASE; PERIOSTEAL CACHEXIA.

Infantile scurvy is a constitutional disease characterized by the symptoms of malnutrition, attended with general debility, anemia, petechiæ and ecchymoses in various parts of the body (principally upon the lower extremities and mucous membranes of the mouth), general muscular weakness, amounting to immobility in the lower extremities (going on to pseudoparalysis). The disease is attended with swelling about the joints and tenderness along the lines of the long bones. It rarely terminates fatally when placed under proper treatment, and it etiologically holds an important relation to the deprivation of fresh foods.

Causes.—Infantile scorbutus usually develops insidiously: a predisposition to rickets, scrofula, and the existence of hereditary syphilis must, of necessity, increase the tendency to the production of the disease. There can be no doubt that in the various proprietary infant foods and sterilized milk there is often lacking a certain something which is needed for a proper nutrition of the tissues, and from such conditions scurvy often arises. Faulty assimilation may in some instances be sufficient to lay the foundation for an attack. It would appear that the source of the evil is to be found in an impaired power of assimilation from the beginning. No known micro-organism has been discovered to produce the disease.

Pathology.—Though we have been enabled to perform but few autopsies, the lesions found are of sufficient importance to deserve attention. The blood, microscopically, presents the appearance observed in anemia, varying in degree with the severity of the attack. The red blood-corpuscles have varied in the observations we have made from 2,200,000 to 3,800,000 in a cubic millimeter, hemoglobin, from 80 per cent. to 50 per cent. The red blood-corpuscles frequently presented the regular appearance known as poikilocytosis, with no other notable change. In one case slight pigmentation was observed.

Macroscopically, hemorrhages, petechial and ecchymotic, are frequently observed in the muscles, kidneys, spleen, gastro-intestinal tract, and osseous system (principally subperiosteal). Ophthalmoscopic examination has shown hemorrhages into the retina which have disappeared under treatment. With the exception of the subperiosteal hemorrhages, the skin and the mucous membranes, principally of the mouth, are most fre-

quently affected. Extensive ulceration of the gums, with exuberant granulation, overlapping the teeth and obscuring them entirely from view, is not an uncommon condition in the advanced stage of the disease.*

In cases terminating fatally hemorrhages, both microscopic and macroscopic, have been observed in all the organs and tissues of the body—the condition becomes an actual blood dyscrasia.

Symptoms.—The symptoms of infantile scorbutus are both constitutional and local. The attack may be precipitated by a number of acute symptoms, gastro-intestinal in character, with fever and the constitutional disturbance associated therewith. The temperature ranges from 100° to 102° F. (37.8° to 38.9° C.); a fever of 105° F. (40.5° C.) and above is rare. More often the disease develops insidiously. The child becomes peevish and fretful, the appetite capricious, though usually poor, temperature but slightly above normal, frequently holding within the normal range. The child lies upon its back, with limbs extended or slightly flexed. The anemia, which at first was slight, becomes more marked, and with it excessive irritability. Pressure along the tibia and femur and about the knee and ankle-joints is attended with considerable pain; the child cries out, but makes but feeble effort to be released. If the disease is far advanced, the position becomes characteristic, the pain becomes acute—now the slightest movement causes the little patient to cry out as if in great suffering. The excessive tenderness about the extremities has frequently occasioned the affection to be mistaken for one of acute rheumatism. The joints themselves are, however, seldom affected. If the skin is carefully examined, not infrequently distinct petechiæ with ecchymoses may be observed upon the legs and thighs. Oftener the mucous membranes, especially the gums, show evidences of the disease; there may be but slight swelling. This is frequently the case before the eruption of the first teeth; afterward the gums become swollen, red, and suffused with blood. The spongy areas show a tendency to bleed upon pressure. This condition may grow worse, going on to ulceration, and presenting in places patches of localized gangrene, the overlapping of the gums completely obscuring the teeth from view. In a case which came under our observation which had been treated locally with a solution of nitrate of silver there was presented all the appearance of linear ulcers along both the upper and lower gums, with exu-

* See "Boston Medical and Surgical Journal," October 29, 1896, article on "Infantile Scorbutus," by Joseph Leidy, M.D.

berant granulations from which there was constant oozing of blood. The enlargement about the joints deserves special note. The swelling is along the shaft of the long bones, about the line of separation between the diaphyses and epiphyses, and outside of the joint proper. The parts are sensitive to pressure, and become extremely painful as the disease advances. There is no rise in the local temperature of the part. The indisposition of the patient to move the limbs is due, primarily, to the pain which is produced upon motion, and in advanced stages of the disease to muscular weakness. This symptom has frequently been mistaken for paralysis. The electric reactions of the muscles are, however, normal; the knee-jerk is usually lessened or lost. This condition of pseudoparalysis is rarely present in the arms.

The heart and circulatory apparatus present no symptoms of importance, except partaking of the constitutional symptoms associated with the febrile movement. In a number of instances hemic murmurs have been noted where the anemia has been marked. The presence of moist rales in the lungs, posteriorly, is not unusual. Hemoptysis is rare, but when present, may be considered a grave symptom.

Kidneys.—Albuminuria is not infrequent. The presence of hyaline and blood-casts is not rare, according to various authorities. In nine cases observed by us, however, in but one were blood-casts and hyaline tube-casts noted.

The symptoms of infantile scorbutus vary in degree from attacks of slight severity to the more advanced and aggravated forms. We have observed that the hemorrhagic condition of the gums is no guide to the state of the lesions in other parts of the body. For instance, in a case which presented but slight swelling of the gums there were persistent hematuria and numerous spots upon the skin. On the other hand, in a case in which the gums were extensively involved, the swelling about the joints was slight, with no marked symptoms referable to the lower extremities. In another, where the patient was brought to us as a supposed case of rheumatism, the weakness in the lower extremities was considerable, the skin showing a marked petechial eruption over the anterior portion of both legs, with no involvement of the gums; and in still another, the hemorrhagic state was general: on the gums, about the pillars of the fauces, with the presence of blood in the urine and stools, and no involvement of the skin. In a case supposed to be one of infantile palsy there was simply weakness in the lower extremities, extreme sensitiveness to pressure over the shafts of the tibia and femur, with slight sponginess of the gums, marked diarrhea, and profound anemia.

Diagnosis.—From the insidious nature of infantile scorbutus, the history of the case, and the character of the symptoms there can be no difficulty in reaching a correct diagnosis. General debility, anemia, sponginess and bloody extravasation of the gums, petechiæ and ecchymoses upon the skin, especially upon the lower extremities, enlargement and tenderness about the joints and along the shafts of the long bones, and an apparent loss of power, muscular rather than nervous in origin, in infants fed upon one of the proprietary foods or sterilized milk, present a picture characteristic of scurvy; finally, the therapeutic test referred to under treatment.

Until within recent years infantile scorbutus was considered a rare affection, doubtless due to the old classification, which included the disease under the head of rickets, purpura in its various forms, and hereditary syphilis.

Differential Diagnosis.—Infantile scorbutus is most frequently confounded in the early stages with acute rheumatism. The records of cases show this to be a most common source of error. The absence of marked febrile disturbance and the location of the swelling about the joints, the condition being devoid of local inflammation, aid us in distinguishing the true nature of the attack. In rheumatism the swelling is confined to the synovial sac; in scurvy it is above and outside of the joint proper. From rickets scorbutus is to be differentiated by the history of the attack and absence of the evidences of rickets, the rapid subsidence of the symptoms under treatment, all of which go to exclude the diagnosis of an affection the symptoms of which are usually of prenatal origin. In those cases where scurvy occurs in children previously the subject of rickets the diagnosis might appear difficult; but even here the rapid disappearance of the acute symptoms under treatment would aid us in eliminating a distinctly constitutional disease.

Prognosis.—Except in the advanced stage of the disease, associated with marked constitutional disturbance, the prognosis is good. Fortunately, it is a disease which rapidly responds to treatment. In those cases seen late, and which have been neglected, the vitality being low, the hopes for recovery are not encouraging, though even here it is astonishing what can be done by a properly arranged regimen.

Duration.—The duration of the disease is variable. In cases early placed under treatment improvement may be rapid, the acute symptoms rapidly subsiding. Instances where the disease extends over a longer period—from six months to a year—are not rare; the danger of laying the foundation for

organic disease must not be lost sight of. Relapses are not uncommon.

Treatment.—The etiology of this affection is a sufficient guide to the treatment. First, change of food to a diet rich in fresh foods is all essential, and is a *sine qua non* of a character suitable to the age of the child. Orange-juice, beef-juice, with the use of perfectly fresh clean milk, for infants, have proved ample in our hands. Medicinally, the use of minute doses of citrate of iron and, later, arsenic in the form of Fowler's solution become useful adjuncts. Hot and cold douches to the extremities, in conjunction with rapid friction, prove highly beneficial during convalescence when the progress is slow.

In those cases which show evidences of gastro-intestinal irritation the use of predigested milk is most satisfactory. The success which follows upon the above course of treatment has occasioned the term "therapeutic test" being applied to it. We can not too strongly urge the course of a mixed diet, rich in fresh food, nor can we too strongly condemn the use of sterilized milk as a routine diet for infants. In the Pasteurization of milk we obtain the same results without the destruction of those elements essential to a proper nutrition of the animal tissues.

SIMPLE ATROPHY.

Synonyms.—INFANTILE ATROPHY; MARASMUS; ATHREPSIA; SIMPLE WASTING.

A pathologic condition characterized by extreme wasting, common enough as the result of many forms of disease in infants and young children, especially the subacute or chronic gastro-intestinal diseases. The majority of cases of so-called marasmus are nothing more than continued starvation, produced by the lack of nutritive elements in the food, supplemented by a chronic toxemia from milk bacteria, producing first a continued gastro-enteric catarrh, and later the group of symptoms of which wasting is the most prominent symptom. It is doubtful whether infantile atrophy ought ever to be described as a separate disease,—it is rather a group of symptoms,—and yet many authors of wide experience, notably Eustace Smith, Holt, and Starr, have so described it. Holt defines infantile atrophy, or marasmus, as "the extreme form of malnutrition seen in infancy, occurring, so far as is known, without constitutional or local organic disease. It is a vice of nutrition only." It must be clearly borne in mind that the immediate cause of true simple atrophy

lies more in the weak assimilative powers, inherited or acquired, of the infant itself, than in any fault of its food, although the latter may be a potent predisposing factor. All diseases in which wasting is a symptom, such as tuberculosis, infantile syphilis, and diseases of the stomach and intestines, must not be included in this class.

Causes.—Marasmus is seen much more frequently among the poor—the class who come to hospitals and dispensaries—than among the well-to-do. It is a disease of the city slums, where children are crowded in tenements amid the worst hygienic surroundings. When seen among the better classes it is usually in infants born prematurely or in children of parents who for generations have been under the average of health or the victims of

FIG. 35.—ACUTE ATROPHY (ACUTE MARASMUS).—(*From patient in the Department of Obstetrics and Diseases of Infancy, Polyclinic Hospital, Philadelphia.*)

inherited disease. It occurs in premature infants not infrequently, and especially in premature children of very young, badly nourished mothers. By far the largest number of cases which come under our notice have been fed on badly prepared milk, usually milk and water, none too clean, the proprietary foods, and condensed milk. "Table food" given too soon may be a cause. Occasionally, but rarely, we have seen a milder form of marasmus in infants whose mother's milk was shown, by analysis, to contain all the elements in proper proportion, but in all of these cases the children themselves were below the average in weight and general health, and in some of them evidences of prenatal rickets later appeared.

Pathology.—Autopsies made on children dying of marasmus are generally unsatisfactory in their results, so far as finding any changes pathognomonic of the condition. Holt states that in one-third of his autopsies he found fatty degeneration of the liver: the organ was enlarged and considerably above the normal weight.

The brain is usually anemic, with dark fluid in the sinuses; marantic thrombi are rare. Frequently small areas of hypostatic pneumonia will be found in the lungs; these are most common on the posterior borders of both lungs, involving the pulmonary tissue to a depth of half an inch. Areas of atelectasis may be seen in the lower lobes of the lungs of young infants; the pleuræ are normal. The heart, spleen, and kidneys are anemic, but otherwise normal. Dilatation of the stomach is sometimes present. The intestines contain food and sometimes mucus. Some enlargement of the solitary follicles of the colon and small intestine may occur, Peyer's patches may be increased in size, and enlargement of the mesenteric glands may also be seen.

Holt summarizes the pathology of the disease as a failure of assimilation from imperfect digestion, due to improper food and unhygienic surroundings or feeble constitution, and from this results a progressive loss of weight, feeble circulation, imperfect expansion of the lungs, and, in consequence of this, deficient oxidation of the blood takes place. The temperature is lowered, and finally a deterioration occurs in the blood itself. At last a point is reached where the small amount of resistance ends and the child dies.

Symptoms.—At birth such children may be fairly well nourished and may so continue until for some cause weaning is necessary, and the infant is fed on some infant food or badly prepared milk. From this time the child begins to lose weight, and although it may be fed frequently, it seems to have a constant desire for food. Almost from the first the infant is irritable, crying continually and never seeming satisfied. Soon the loss of weight begins to show: the form loses its plumpness, the outlines of the ribs are seen, and the various joints are plainly marked. The wasting is most distinct in the limbs and face, the latter assuming an expression which is eminently characteristic of the disease. The eyes become sunken, and the great wasting in the lower part of the face makes the forehead, by contrast, appear unusually prominent. The whole face assumes a triangular shape, the ears are prominent, the cheeks are sunken, while deep furrows appear around the mouth. The expression is curiously aged. The child soon becomes anemic, with considerable

reduction in hemoglobin. Holt states that in his cases he has seen the hemoglobin as low as 30 per cent., and in one case it was reduced to 18 per cent. There is extreme pallor, especially of the face, except late in the disease, when patches of pulmonary atelectasis occur, giving the skin, from nonaëration of the blood, a somewhat leaden hue. Heart murmurs, due to anemia, are frequent. The abdomen is generally distended and filled with gases, produced by faulty digestion. The muscles appear to be small and atrophic, and are covered by no fat. The skin hangs in folds, and is generally dry and scurfy. Various forms of skin eruptions are common; the buttocks and genitals are covered by erythema. Thrush or other forms of stomatitis are frequent; bed-sores appear later. The temperature may be normal, subnormal, or slightly elevated. Most commonly it is below the norm; it may fall as low as 95° or 96° F. (35° to 35.6° C.). Not infrequently there is a slight rise at night. The appetite, which is generally ravenous in the early part of the disease, fails entirely, and when food is taken, it is followed by severe vomiting. The tongue is coated, the digestion poor, and the power of assimilation in most cases is practically *nil*. The bowels are constipated or irregular; there may be diarrhea. The movements are greenish yellow in color and contain considerable mucus. Colic is nearly always present. The nervous symptoms are sometimes very severe; in the earlier stages the child is restless, particularly at night; the whole nervous system is hypersensitive, this showing itself in a strong tendency to convulsions. In the late stages there may be some retraction of the head and a decubitus much like that seen in tubercular meningitis. Physical signs referable to the heart and lungs are generally negative, except that there may be anemic murmurs, before referred to, and a certain amount of bronchial irritation is very commonly seen. Small areas of pulmonary atelectasis may be found, or the evidences of hypostatic pneumonia; these latter usually appear toward the end, and are a grave symptom. The urine is of a dark-yellowish color, and ranges from 1010 to 1013 in specific gravity. Albumin and, more rarely, sugar may be found in it. Edema may be a symptom, and when it appears, is nearly always a sign of a fatal termination.

Diagnosis.—The disease with which simple atrophy is most likely to be confounded is general tuberculosis; indeed, the symptoms of the two diseases are so much alike that it is impossible sometimes to differentiate between them without an autopsy. Cases of tuberculosis are sometimes seen with few symptoms except those of marasmus, and occasionally children dying of

simple atrophy will have a few patches of tubercle in their lungs. Even when pulmonary dullness is present,—and it often is late in the disease,—it may be from hypostatic pneumonia. Holt, however, has pointed out that the dullness of hypostatic congestion is most likely to be found in the posterior portions of the lungs, while that of tuberculosis is commonly in the anterior lobes. In some cases the infant affected with marasmus may be healthy at birth, the disease developing later, while tuberculosis may develop at a very early age. In tuberculosis the elevation of temperature is greater and more regular, with morning remission and evening rise. Frequently the pulmonary symptoms are rather more marked than are those of acute atrophy. Tubercular meningitis may be differentiated by the presence of general meningeal symptoms, the palsies, or contraction, the long-continued decubitus, and the full pulsating fontanel, the latter in simple atrophy being depressed. The scaphoid abdomen is usually seen in meningitis, while in atrophy it is enlarged or entirely depressed. In meningitis there is usually the hydrocephalic cry. Syphilis may be distinguished by its characteristic eruption, the presence of mucous patches, and the specific coryza seen soon after birth. Enlargement of the liver, spleen, and knee-joints will aid in the diagnosis.

Prognosis.—The outlook for recovery depends considerably on the age of the child, the younger the patient, the worse the prognosis. The duration of the disease is also a factor to be taken into account; naturally, a child affected with marasmus for a long time will be more reduced in its powers of resistance than one in whom the condition has lasted but a short time. The most important element in the prognosis is the previous care which the infant has received, especially in the matter of its food and general hygiene. In those infants who have been fed for a long time on badly prepared artificial foods the prognosis is not the best. In our experience the worst cases have been those who have been fed on condensed milk since birth. In these the prognosis has generally been unfavorable.

Treatment.—The most important element in the treatment of simple atrophy is its prevention. This among the poor, the class in which it is most common, should consist in teaching the mothers from the first the proper manner in which to feed their babies. In most cases it is very little if any more trouble for a mother to prepare milk in a proper and cleanly manner than in an improper and dirty way, and she will usually do the former if she is taught how. In dispensaries a few clearly printed rules can be used, giving explicit directions as to the proper manner of

preparing milk and other foods employed; these directions should include the general care of the child, as to its bathing, clothes, and exercise. These children should receive as much fresh air as possible, and the necessity of regular bathing should be impressed on the mother. It is also of importance that infants with weak digestive powers should be fed from the breast for at least nine months, providing the mother's milk is fairly good. If the maternal supply has become so much decreased that the infant can not be entirely fed from the breast, it is better to use mixed feeding—partly breast and partly modified cow's milk—than wholly to depend on artificial feeding. Wet-nurses are of great use in this class of patients, and should be frequently employed if the infant is under six months old. Among the poor and ignorant the use of milk modified at home will often result in failure, yet by patiently teaching the mother how to so feed her child we may often accomplish much. In hospitals and among the well-to-do artificial feeding by carefully prepared modified milk will frequently be successful, particularly if the infant is over six months old. At first a milk mixture low in proteids and fats should be used, and this will frequently have to be predigested. A formula such as the following may be found useful:

Fat,	1	to 5	per cent.
Sugar,	6	to 7	"
Proteids,	0.75	to 1	"

In one case we were successful with the following:

Fat,	3	per cent.
Sugar,	6	"
Proteids,	0.4	"

If these are assimilated, the proportion of fat and proteids must be raised from time to time. The child should be weighed at regular frequent intervals. In very young infants with subnormal temperature incubation is often of use, or, a couveuse not being at hand, the child may be wrapped in raw cotton and laid in a basket or small crib, with one or two bottles of hot water or a hot-water bag. The management in these cases is very much the same as that of premature infants. Holt suggests that they be made to cry vigorously several times a day, in order to keep the lungs expanded. In older children massage with oil inunctions is of use. Drugs, as a rule, are of very little account. If the child improves, a change of air at the seaside or mountains may prove of benefit.

DIABETES MELLITUS.

Diabetes mellitus, also called saccharine diabetes or glycosuria, is a constitutional disorder of the elaborative functions of nutrition, characterized by a persistent and excessive secretion of saccharine urine, polyuria, great thirst, excessive appetite, rapid emaciation, and especially in children an early fatal termination.

Causes.—Heredity, and especially an inherited lessened capacity for the digestion of the carbohydrates, seems to play a large rôle in its etiology. The disease is apt to be a legacy from a neurotic or gouty ancestry. Long-continued dietetic errors, by deranging the processes of nutrition, may predispose to it. Exposure to cold, traumatism, acute infectious diseases, climate, syphilis, and malaria, disorders of the liver and pancreas, all seem to assume an etiologic relation. Its frequency among Jews is remarked by all writers.

Morbid Anatomy.—No constant lesion is present in diabetes; those encountered are usually consequences, rather than causes, of the disease. The pancreas has been found to be the seat of disease in a large proportion of cases, the conditions observed being atrophy, fatty degeneration, suppuration, and fibrous inflammation, concretions, cysts, and tumors of this organ. Complete extirpation of the pancreas in animals always produces diabetes, while partial removal or ligation of the duct is not followed by such a result (von Mehring and Minkowski). These experiments suggest that it is the function of the pancreas to control metamorphosis of sugar in the body. It has been suggested (Lepine) that the pancreas produces a ferment which is necessary to the normal metamorphosis of sugar. The liver is often enlarged and fatty; cirrhosis and pigmentary degeneration have been observed. The lungs often present evidences of tuberculosis. The kidneys in many instances are diseased.

The infrequency of diabetes in childhood is to be explained by the activity of the nutritive processes in early life. No theory, physiologic, pathologic, or chemic, will explain all cases of diabetes. It is known that it sometimes follows diseases and traumatisms of the central and peripheral nervous systems. Physiologic chemistry has demonstrated that glycogenesis is sometimes the result of interruption in the metabolism of the carbohydrates; sometimes an inexplicable derangement in the metabolism of the nitrogenous elements of food. The relation of diabetes to the glycogenic function of the liver is still undecided; some maintain that it arises from the arrest of the carbohydrates in the liver, or from the arrested or perverted glycogenic

function of the liver, so that sugar is poured into the circulation and causes diabetes. Others maintain (Pavy) that the liver is a sugar-destroying and not a sugar-forming organ, and claim that the carbohydrates are partly converted into fat in the intestines and partly into glycogen in the liver, and that diabetes results from the overloading of the circulation with sugar through a failure of these functions. From a chemic point of view it is essentially a disease of suboxidation of the elements of food—nitrogenous as well as nonnitrogenous.

Symptoms.—The disease in children differs from its course in adults chiefly in its more rapid, often sudden, development, and in its early fatal termination. The child, in spite of excellent appetite and ample food, grows thin and emaciates rapidly, and the skin becomes dry and toneless. Thirst and appetite are excessive. There is a frequent desire to void urine, which is passed in large quantities and upon examination is found to be usually of high specific gravity, marked acidity, pale and sometimes greenish in color, sweetish taste, aromatic odor, and to contain sugar and to ferment rapidly. The amount of urine may vary from 1000 to 6000 c.c. (1 to 6 qts.) in twenty-four hours, the specific gravity being from 1030 to 1040, the proportion of sugar from 1 to 10 per cent. Incontinence of urine is often the first symptom; and when accompanied with thirst and marked wasting, is always suspicious. Peevishness, restlessness, itching of the genitalia, constipation, and sensitiveness to cold are other symptoms frequently observed. The tongue is beefy, red, and may be fissured, the skin dry and roughened, and the patellar reflexes are diminished and at times lost.

Diagnosis.—A recognition of the persistent presence of sugar in the urine determines the diagnosis. A careful examination of the urine should be made in all cases of polyuria or incontinence. Whenever possible, it is desirable to examine a portion of the entire quantity of urine passed in twenty-four hours—where this is not obtainable, a specimen voided two to four hours after a meal is most likely to show the presence of sugar when the amount is small.

Fehling's Test.—For *qualitative* testing take one cubic centimeter of the test solution and dilute it with four cubic centimeters of water; boil this, and if no precipitate occurs and the solution remains clear, it is fit to be used; if not, a fresh solution should be obtained. To the test solution, after boiling, add the urine, drop by drop, until a bulk not exceeding the amount of test solution has been added; if no yellow or red precipitate takes place, sugar is absent.

An approximately accurate *quantitative* test can be made with Fehling's solution, employed as in the foregoing test, if it is remembered that an equal amount of urine which exactly reduces the test solution contains ½ of 1 per cent. of sugar. If the color is removed by an amount of urine equal to half of the bulk of the test solution, that urine contains 1 per cent. of sugar; if the amount of urine necessary to remove the color from the test solution amounts to twice the bulk of the test solution, it contains ¼ of 1 per cent. Urine containing a large percentage of sugar should be diluted in the proportion of 1 to 9 of water, and the diluted urine employed in testing for sugar; the result obtained should be multiplied by ten.

Phenyl Hydrazin Test.—To fifty cubic centimeters of urine add from one to two grams of hydrochlorate of phenyl hydrazin and two grams of sodium acetate; heat on a water-bath one hour; on cooling there will appear at the bottom of the beaker a crystalline or amorphous precipitate, which under the microscope has the form of the characteristic yellow needles of phenyl glucosazone. It is claimed that this test will show 0.05 per cent. of sugar. It gives no reaction with the other organic substances in the urine, as uric acid, kreatinin, hippuric acid, etc.

The Fermentation Test.—This serves the double purpose of a quantitative and a qualitative test. Fill a four-ounce bottle with the urine whose specific gravity has been determined. To it add a piece of compressed yeast, the size of a bean, or a teaspoonful of brewer's yeast; mix thoroughly, and stand in a warm place (70° to 80° F.—21.1° to 26.7° C.) for twelve hours or longer. At the expiration of this time the sugar will have been converted by fermentation into carbonic acid gas and alcohol and the specific gravity lowered. For every degree lost in specific gravity there is one grain of sugar to the fluidounce. Thus, if the original specific gravity is 1040, and after fermentation 1020, there are twenty grains of sugar to the fluidounce. From this the percentage may be ascertained by multiplying the number of degrees lost by 0.23. Thus, in urine losing twenty points in specific gravity the percentage of sugar would be 4.6 per cent.

Prognosis.—Diabetes in children is essentially an incurable disease; the younger the patient, the more rapid the fatality. The course of the disease rarely exceeds six months.

Treatment.—In children diabetes does not permit of classification as it does in adults, in whom we recognize at least two forms of the disease. No recoveries from true diabetes in children have been reported. The hygienic treatment is important, especially the maintenance of the best condition of the skin.

To enable one whose skin is not robust to endure and benefit by cool bathing it is an important safeguard to precede this by a brisk rub-down. Patients should be protected by woolen clothing from cold, which is their worst enemy. Frequent bathing should be employed, and should be preceded as well as succeeded by brisk friction to keep skin and circulation active. Guard against chilling, constipation, and excessive acidity of the urine. Outdoor life and muscular exercise, always short of fatigue, should be insisted upon. In the matter of diet the aim should be, at the exclusion of the carbohydrates, to diminish the glycosuria and polyuria. The attempt at absolute exclusion will be found useless or impossible, as the chief substitute for ordinary bread, the so-called gluten bread, usually contains a varying amount of starch. It is probably more advantageous to permit a small amount of ordinary bread or crusts of bread and bran bread, the amount being determined by its effect upon sugar excretion, than to allow a large amount of gluten bread with its uncertain amount of starch. Cakes made of almond flour from which the sugar has been removed, and cakes of inula, as well as preparations made from various other flours, as poluboskos and soy-bean flour, may prove of temporary benefit, but none of them will still the craving of the patient for "the staff of life"—ordinary bread. Saccharin, glycerin, and levulose may be used as sweetening agents.

The **medicinal treatment** does not present much encouragement. Aside from opium preparations, which are the only drugs capable of checking the disease in most cases, there is no drug which distinctly influences its progress. Codein produces the least systemic disturbance, but is not so effective as the extract of opium, which of all preparations is the best. It should never be given in sufficient amount to produce narcosis. The bromid of arsenic is useful in mild cases, but unfortunately we do not meet them in children. Fluid extract of ergot in full doses is sometimes helpful. Treatment by thyroid, thymus, and pancreatic extracts internally and subcutaneously has not met with success. Fluid extract of jambul, used extensively in India, has proved another disappointment. Strychnin, laxatives, and cod-liver oil are useful to meet symptoms. Alkaline waters are beneficial and should always be employed when there is an excessive acidity of the urine, thus warding off an attack of coma. Salicylate of soda in rheumatic cases has obtained some reputation for its beneficial effect upon diabetes.

URIC ACID AND URIC ACID CONDITIONS.

At the present time there are divergent views as to the source of uric acid and the seat of its formation, although the trend of opinion seems to be in favor of the view that assigns to the kidneys the office not only of secretion, but of actual elaboration, and that holds that uric acid is derived from the nuclein of the body-cells (chiefly the leukocytes) and not directly from the proteid elements of the food, except as the latter promotes a digestive leukocytosis, thereby increasing the destruction of nuclein. Urea also may contribute its share.

Uric acid is *increased* by food rich in nuclein—bone-marrow, liver, brains, pancreas, veal, tea, coffee, meat extracts, and asparagus—and in any disease that impairs respiration or circulation, in affections of the liver and spleen, in anemia, in most acute diseases, and in gout following the paroxysm; also by certain drugs, as pilocarpin, salicylic acid, antipyrin, phosphorus, etc. It is *decreased* by nonnitrogenous diet, in advanced stages of disease of the kidneys, in gout during the paroxysm, and in most chronic states.

Uric acid is normally in the urine in the form of what is known as the mixed urates of sodium, potassium, and ammonium (acid and neutral urates). The neutral salts are freely soluble in water, the acid urates feebly so, while uric acid itself is almost insoluble. The uric acid and urates are held in solution by the presence in the urine of the normal coloring-matters, by the salts (chiefly the chlorids), and by a low degree of acidity; for with a reduction in the proportion of the salts and pigments and an increase in acidity the uric acid will be precipitated, although there may be less than the normal amount present. This precipitation, however, is pathologic only when it takes place while the urine is still within the body. It must be remembered that the harmful effects of uric acid are due solely to the mechanical irritation of its crystals, whether they be precipitated within the urinary tract or in the tissues of the body, for uric acid itself possesses no poisonous properties.

When crystals of uric acid are deposited in the tubules of the kidney, there may be present the symptoms of renal irritation—sense of weight or pain in the lumbar region, or pain referred to the umbilicus; occasionally there may be nausea and vomiting. In other cases the child may only show signs of mild mental depression, irritability of temper, and insomnia, with variable appetite; constipation is also apt to be present. Sometimes enuresis may be the only symptom. Whenever such a train of

symptoms, without obvious cause, makes its appearance suddenly, suspicion should always point to a possible uric acid precipitation and suggest an examination of the urine.

When the tubules of the kidneys are the seat of actual irritation from the continued presence of uric acid crystals, an examination of the urine would show the presence of small amounts of nucleoalbumin and serum albumin, usually hyaline casts and cylindroids, and, occasionally, a few granular and epithelial casts, or even leukocytes and erythrocytes. No doubt many cases of granular kidney have had their origin in this continued irritation from uric acid crystals which has escaped recognition. Gravel and calculus are attended with symptoms identical with those in the adult.

Although few cases of gout in children are reported, it is likely that it is often not recognized.

Treatment.—The treatment is dependent upon whether the condition is one of excessive formation of uric acid or of a state of lessened solubility of the urine.

As a general rule meats should be allowed but sparingly, and only when a proper amount of exercise is taken. This exercise should always be insisted upon. Milk, white of egg, cereals, lettuce, celery, and fresh fruits constitute the best diet. Asparagus is to be avoided, as it contains one of the xanthin bodies. Fats and starches in moderation may be allowed unless they give rise to digestive disturbance. When an oxaluria exists, spinach, rhubarb, tea, cocoa, coffee, tomatoes, strawberries, etc., are contraindicated, as they contain oxalate of calcium. Pastry and sweets have been shown by clinical experience to do harm.

The citrate of lithium or its carbonate as an effervescing draft is often useful. When the urine is strongly acid, alkalies should be employed, such as the citrate of potassium or bicarbonate of soda, in doses of from ten to twenty grains well diluted. An evening dose is most important, for it is during sleep in the long fasting period between the evening and morning meals that the urine attains its highest degree of acidity.

The urine must be examined immediately after being voided and preferably while still warm. For quantitative analysis, the method of Hopkins is preferred by the authors for ordinary use. When such test is impossible, an approximate estimation may be made in the following way: Given a specimen of urine in which uric acid crystals have been demonstrated by the microscope and in which there is a fair proportion of the normal coloring-matters and salts, accompanied with a moderate degree of acidity, it may be inferred that the precipitation is due to excessive formation.

CHAPTER XII.

DISEASES OF THE HEART.

GENERAL CONSIDERATIONS.

Anatomy.—Normally, within the first ten days after birth the circulation may be said to lose its fetal type wholly and assume extra-uterine characteristics. The changes occur at slightly variable periods. They include the conversion of the ductus arteriosus and ductus venosus into fibrous cords; the closure of the foramen ovale; changes in the umbilical veins and umbilical arteries, the first forming the round ligament of the liver, the second the true anterior ligament of the bladder and the superior vesical arteries.

In the early weeks of postuterine existence one may clearly see the remnant of the Eustachian valve, and though the foramen ovale is closed, yet it is distinctly outlined. Variations in the weight of the heart at different ages are shown in the following table of Boyd's:

Age.	Grams.
At birth,	20.6
One and one-half years,	44.5
Three years,	60.2
Five and one-half years,	72.8
Ten and one-half years,	122.6
Seventeen years,	233.7

The relative weight of the organ is greatest at birth, and the right side predominates to a slight degree over the left. In infancy and early childhood the long axis of the heart is more horizontal in the thoracic cavity than it is in later life.*

Physiology.—Independent of its nervous mechanisms the cardiac muscle appears to possess a property of rhythmic contractility. The controlling influence of the nervous system is of extreme importance, however, in the lower animals. Ganglia

* Relatively, the heart is small and the blood-vessels very large in capacity. Thus, high arterial pressure is much less likely to result than in the adult.

and plexuses are found in the heart, the former being inhibitory or augmentory in function. The center for the extrinsic controlling mechanism lies in the bulb, inhibitory impulses passing from it down the pneumogastric nerves, and the majority of the augmenter impulses passing down the spinal cord and to the cardiac plexuses through the medium of the sympathetic system.

Inhibition is undoubtedly nature's method of conserving tissue and energy (anabolism), and the inhibitory centers are constantly active. Augmentation is synonymous with catabolism.

Though our knowledge of these central agencies is far from perfect, yet they cast many important side-lights upon the functional cardiac disturbances in children, and it seems clear that rational treatment must depend somewhat upon this physiologic knowledge. The average pulse-rate at birth is 136, and is usually somewhat faster in the female infant. For later periods of life Holt gives the following figures:

Six to twelve months,	105 to 115 a minute.
Two to six years,	90 to 105 "
Seven to ten years,	80 to 90 "
Eleven to fourteen years,	75 to 85 "

Very wide variations from these average rates may result, however, from most trivial causes. (See Functional Disturbances of the Heart, p. 398.)

Examination of the Heart.—The heart lies so superficially in the young subject, so rapid is the action, and so frequent are the variations in rhythm that a satisfactory examination may be extremely difficult. A careful pursuance of the various steps of inspection, palpation, percussion, and auscultation is always more or less fruitful of results.

The ribs in a child are placed more horizontally than in the adult; the diaphragm is higher, therefore the heart is higher in the thorax. The heart is also more horizontal, with the apical impulse, especially in the very young, felt somewhat outside of the mammillary line.

The liver in young children is larger in proportion than in adults, hence, as the heart is in close contact with this, the area of cardiac dullness merges into that of the liver dullness below. Though the heart does float in the pericardial fluid, it changes very little in the different positions assumed by the child. Bulging of the precordia in the child may constitute a most important evidence of cardiac disease.

We can scarcely avoid mention of an old mode of examination to which Benedict has redirected attention recently. We refer to a combination of the last two methods, or *auscultatory*

percussion. This method has been frequently applied in outlining the gastric viscus, but not until lately have we been enabled to demonstrate its value in mapping out the size of the human heart. Only the *deep* or "*relative*" cardiac dullness can be studied thus, but this is the area which tells us most surely of the cardiac bulk and sizes of various cavities. The lightest immediate percussion will serve in this study. The outlines of the heart may be traced upon the chest with an anilin dye or some oily preparation. These lines can then be transferred to tissue-paper. In this way exact records may be secured and kept.

The phonendoscope is of special value in auscultatory percussion, and in listening to the sounds of the heart through clothing. It usually interests rather than annoys the child who is being examined. We would not, however, recommend the student to depend *wholly* upon instruments which amplify sounds, but carefully to train his ear by studying cardiac sounds with the intervention only of the examining towel. Thus can the quality of sounds, their rhythm, force, and intensity, be fairly compared.

Starr prefers to inspect and auscultate before resorting to the more disturbing methods of physical examination.

The following aphorisms are drawn from Crandall:

1. The apex lies higher in the chest and further to the left than in the adult.

2. The apex-beat is hard to detect in the infant. In the child palpation shows this easier than in the adult.

3. The area of dullness is comparatively large. (Rotch indicates three stages in infancy and childhood during which differences are noted in relative and absolute dullness.)

4. Murmurs are heard over comparatively large areas. A study of differences in the quality of the sounds and points of greatest intensity will help us here.

5. The rate may be increased and the rhythm altered by slight causes.

6. In rachitic children and in those affected by empyema or pleural effusions and adhesions the apex may appear in an abnormal position.

7. Prominence of the precordia is sometimes marked. Normally the loudest sound is the first sound at the apex; the weakest sound is the second sound at the aortic cartilage. This accords with our experience, though it does not seem to be generally recognized that the pulmonic second sound is in early life stronger than the aortic sound.

The examination should always be performed during sleep, or in a state free from physical or psychic disturbance, and a child

should never be frightened with a formidable looking stethoscope or other instrument.

CLASSIFICATION OF CARDIAC DISEASES.

Time of Occurrence.	Nature of the Affection.	Clinical Disease.
Intra-uterine existence or very early infancy.	Developmental or Inflammatory.	Various congenital affections.
Extra-uterine existence (infancy or childhood).	Various motor or sensory phenomena, unaccompanied by sensible changes of structure.	Functional diseases of the heart.
	Organic — Mechanical.	Dilatation, Hypertrophy — Alone or as accompaniment of inflammatory change.
	Organic — Inflammatory.	Pericarditis, acute or chronic. Endocarditis, acute or chronic. Myocarditis, acute or chronic.
	Miscellaneous.	Effusions (noninflammatory). Granulomata. Neoplasms.

The Importance of Physical Signs other than Murmurs in the Diagnosis of Valvular Disease of the Heart.—Textbooks teach that an endocardial murmur is not always an evidence of a valvular lesion, and also that a valvular defect may exist and still no murmur be present. Practically, however, conclusions are usually based upon the presence or absence of murmur. There may be a valvular disease without a distinct murmur being audible, and therefore other signs than murmur must be used in determining the existence of a valvular lesion. Every valvular lesion of importance must result in hypertrophy and dilatation of the heart behind the valve diseased. An increase in tension of the pulmonary circulation follows any valvular lesion at the mitral orifice and, later, any aortic disease. This will show in increased force of the pulmonic second sound.

Stenosis of the orifices of the left heart means a smaller amount of blood in the general arterial circulation; therefore lessened arterial pressure.

Failure of the right heart is followed by venous congestion—*e. g.*, venous pulse, hepatic and portal congestion, anasarca, etc. The last condition is much more frequently dependent upon renal disease when it appears in the child.

Hypertrophy may be recognized by the heaving, forcible apex impulse, though one may be misled by a thin chest-wall. Epigastric pulsation may call attention to enlarged right heart. The jugular pulse, the hepatic, and the capillary pulse are all of diagnostic value. The visible pulse of aortic regurgitation is almost pathognomonic.

Palpation is very important, certainly *most* important in locating the apex-beat. Characteristic thrills may be perceived by palpation. The force of the cardiac impulse and the sites of abnormal pulsations are also learned through touch. Extracardiac causes for murmur, such as might arise in a heart dislocated by pressure or retraction, can usually be excluded by percussion.

A weak aortic sound may be an indication of obstruction. The reduplicated second sound may point to valvular disease (stenosis of mitral orifice). A sharply accentuated first sound at the apex is likewise common in mitral stenosis. The peripheral tones in aortic regurgitation are a valuable confirmation.

Error in calling an inorganic murmur organic is readily made unless the secondary sounds are carefully sought for. We must not undervalue the importance of endocardial murmur, but bear in mind that it is only by the complexus of symptoms that an accurate diagnosis can be made. Of all the evidences of heart disease, the least valuable is the endocardial murmur.

CONGENITAL DISEASES OF THE HEART.

To the embryologist and the pathologist these lesions are of considerable interest. To the clinician less importance attaches to them, because exact diagnoses are sometimes impossible, and manifestly our best therapeutic measures are often utterly useless. In the last few years, however, a rather exceptional experience has led us to array ourselves with those who believe that not infrequently an accurate diagnosis is at least as possible as it is in the presence of acquired cardiac lesions.*

We believe that congenital cardiac disease is much more common than it is usually supposed to be, and that as a cause of death in early infancy it is frequently unrecognized.

Hirst, following Baginsky, adopts the classification below appended:

1. Patency of the Foramen Ovale.—This lesion is of slight importance, unless accompanied by a marked defect of the

* In the short period of a fortnight one of us saw three "blue babies" and an older girl who almost unquestionably had pulmonary stenosis.

muscular wall. As a rule, this lesion is not accompanied by a murmur, and if it is, the sound is likely to be diastolic in time. Holt found small openings in fully one-fourth of his autopsies on infants under six months old.

2. *Defect of the Ventricular Septum.*—Absence of this structure causes the *cor triloculare*. Frequently the auricular septum is also absent, and we have the *cor biloculare*. This lesion is commonly associated with pulmonary stenosis. When in the presence of congenital cardiac disease one hears a murmur which is systolic in time, whose greatest intensity is at the midsternum, and which is transmitted toward the left, the probability is that there is a defect in the septum ventriculorum.

3. *Anomalies of the Auriculoventricular Valves.*—These are much more common on the right side of the heart. Such lesions may be inflammatory (sclerotic endocarditis) or contractions may follow at the sites of small hematomata (Rotch). More rarely the valves are bound together, forming an annular diaphragm, and in exceptional cases atresia of the orifice may be found.

4. *Stenosis and Atresia of the Pulmonary Artery.*—Stenosis of this vessel is the most common and the most important congenital affection, for, unless some sudden strain be thrown upon the heart, such cases may reach adult life.

The lesion may be due to intra-uterine endocarditis or it may be developmental. Complete atresia is exceedingly rare. Obviously, the blood supply to the lungs would be materially restricted. Thus, one is not surprised to learn that many of these cases perish from pulmonary tuberculosis. Subsequent valvulitis is also to be expected. Stenosis of the conus arteriosus is occasionally observed. A diagnosis of pulmonary stenosis is based upon the symptoms and signs of congenital cardiac disease, and upon the following finds: (1) A systolic murmur heard best at the pulmonic cartilage, and not transmitted into the great vessels. (2) The presence of a decided thrill at the same site. (3) Right-sided hypertrophy is sometimes observed, though it need not be present when there is a deficient septum ventriculorum.

5. *Persistence of the Ductus Arteriosus.*—Absence of this vessel has been observed. The obliterative endarteritis (Warren) by which this structure becomes closed may involve the isthmus aortæ. The murmur present in patulous ductus arteriosus is systolic in time, heard best at the pulmonic cartilage, but differs from that of pulmonary stenosis because it is transmitted along the great arterial trunks.

6. *Stenosis of the Aorta.*—Stenosis of the aorta is much less common than the similar condition of the pulmonary artery, and

is inversely of more serious potentiality. Complete atresia may exist, and, as in deformities of the right side of the heart, the conus arteriosus may be stenosed.

7. Transpositions of the Arterial Trunks.—These cases, which may be observed alone or in connection with other visceral transpositions, rarely live to term. When other visceral transpositions accompany the cardiac one, less difficulty should be experienced in diagnosis.

8. Numerical Anomalies of the Valve Segments.

9. Gross Anomalies.—Acardia; ectopia cordis; displacement upward or downward; ill-developed heart; bifid apex; absence of pericardium, etc. These anomalies may accompany other gross developmental malformations, such as spina bifida or hydrocephalus.

Symptoms.—Cyanosis is present in about 90 per cent. of cases of congenital deformities of the heart (Osler); it usually appears early, but in a case seen by us at the Philadelphia Hospital it was not present until a few hours before death. The blueness may be quite general, or may appear only in the lips, nose, eyes, fingers, and toes. Peripheral temperature is lowered. Dyspnea and cough are common symptoms. Such children are always puny of body and stunted in mind. The fingers are markedly clubbed. The child fails to develop generally. (See chapter on Physical Development.)

Diagnosis.—The diagnosis of the exact condition is impossible in some cases, yet when cyanosis, cardiac hypertrophy, and murmurs are present, one can safely say that there is congenital cardiac disease present. We have briefly outlined the auscultatory signs of importance in the diagnosis of the most common lesions.

Prognosis.—This is grave in the majority of instances. A patulous foramen ovale is not incompatible with life, and 16 per cent. of the cases of pulmonary stenosis reach the age of twenty years (Assum).

Treatment.—This is essentially hygienic. "If," as Jacobi says, "they be so unfortunate as to grow up, exercise should be avoided." Warm clothing and a mild, equable climate will serve to prevent the internal congestions and the bronchitis, which may serve as fatal disturbances to a damaged and overladen circulatory apparatus. Salt baths and inunctions of the skin with oil or fat are measures that appear of some practical aid in conserving nutrition.

Tonics will be of use as indicated, and digitalis may prove of service in crises.

FUNCTIONAL DISTURBANCES OF THE HEART.

During the developmental epochs the heart is especially liable to disturbances of rhythmic action, but infants, as a rule, escape. Older children are thus troubled, however, especially as puberty approaches and during and after that time. Exciting causes, such as confinement indoors, a sedentary or overlaborious life, the use of improper food, tea, coffee, or tobacco, readily affect the growing tissues of so delicately poised an organ; also the effect of poisons of various sorts, as in the acute infectious fevers.

These affections are practically neuroses, and are not accompanied by demonstrable changes in structure; hence, are thus designated functional.

Wilson classifies the symptoms in the following table:

I. Motor disturbances:
   1. Derangements of rhythm.
      (*a*) Arhythmia; (*b*) tachycardia.
   2. Momentary syncope.

II. Sensory disturbances:
   (*a*) Heart consciousness; (*b*) distress; (*c*) pain.

III. Motor and sensory disturbances combined:
   Palpitation.

Obviously this is but a classification of symptoms and throws no light upon the existing conditions upon which these symptoms are dependent. Indeed, arhythmia may be noticed in perfectly healthy children during sleep, and, as before mentioned, the cardiac rate may be affected by trivial circumstances. On the other hand, some of these symptoms may be observed in organic heart or brain disease. We would recall attention to our brief summary of the physiology of the heart. It has been found experimentally that the rate, the force, and the rhythm may be affected by position, exercise, the condition of the cardiac muscle, the states of activity of the intrinsic and extrinsic nervous centers, the blood pressure, the degree of ventricular distention, acids and alkalies in the blood, the temperature of the blood, the quality of the blood, the condition of the coronary circulation, local heat and cold, drugs, also reflexes from various localities.

Causes.—Anemia will be found as the most frequent cause of palpitation, etc.; tea- and coffee-drinking is far from an uncommon factor of disturbed cardiac rate and force; exophthalmic goiter is occasionally observed in childhood; so various disor-

ders of metabolism with circulatory toxins are competent causes. Eye-strain, dyspepsia, gastro-intestinal fermentation, and naso-pharyngeal growths will serve as examples of reflex causes.

Paroxysmal tachycardia, so thoroughly studied by Nothnagel, we have not observed. It must be remembered that many of the reported cases have displayed organic lesions of the heart or nervous mechanism in addition, and one should look carefully for such lesions before regarding such individuals as subjects of neuroses only.

Sansom reports 100 cases of influenza, with tachycardia in 37 cases, irregular heart in 25, and bradycardia in 5 cases. Our experience amply confirms the influence of the influenza poison upon the circulatory apparatus. Increase or slowing of the rate and abnormalities of rhythm frequently persist for a long time as resultants of this infectious disease. The irregularities in cardiac action so frequently seen accompanying chorea, and which often pass away, leaving apparently no lesion, are in all probability instances of slight endocardial damage. These may not recur, but represent too often the initial lesion, becoming subsequently serious and disabling.

Diagnosis.—Our physiologic knowledge of cardiac structure, action, and normal variations should lead us to investigate etiologically, and not rest content with the diagnosis of a symptom. Our observations at the Polyclinic Hospital would lead us to believe that Da Costa's classification applies equally to children, and that many cases may be grouped under the heads of *muscular weakness* or *nervous weakness* of the heart. Of course, these conditions may be accompanied by general asthenic states. One could scarcely leave the subject of functional disorders of the heart without a reference to the so-called *functional* or *accidental murmurs*. As a rule, these are not heard in infancy, though the question is a moot one. These murmurs in childhood, particularly in older children, are of fairly common occurrence. Generally they are systolic in time. They are most frequently heard in the neighborhood of the pulmonic cartilage, and probably next at the apex. They are usually soft in quality, but may be quite harsh. Transmission does not pursue the laws followed in valvular disease, but exceptionally these murmurs are heard over considerable areas. Enlargement of the cardiac area is never present to any marked degree.

We can not afford the space to dwell upon the various theories advanced to explain these interesting murmurs; suffice it to say that no one theory satisfactorily accounts for all of these sounds.

Prognosis.—This will depend upon the gravity of the underlying conditions. As a rule, prognosis is decidedly favorable when organic cause is excluded.

Treatment must also depend upon the cause or causes of the symptom. In most cases it is largely hygienic. Attention to diet is always called for, as reflexes arising through the pneumogastric nerve—for instance, those from a dilated stomach—may mechanically influence the heart. If syncopal seizures are noticed, the child must be kept in bed, and there treated by massage, proper bathing, and a concentrated nutritious diet. Iron and arsenic used judiciously are of value in anemia. When the first sound of the heart is weak, or when tachycardia is accompanied by syncope, strychnin in small divided doses is our best remedy.

Hygienic measures are of most practical utility, including attention to the skin, lungs, bowels, and digestion, especially intestinal digestion and absorption, and careful regulation of the bowels, avoidance of autointoxication from defective elimination.

The Bad Nauheim (so-called Schott) method of systematic bathing and of exercise aga' .st gentle resistance would seem to find its widest field in such cases. Even where the heart has been crippled by organic disease, however, good results have been produced. We would certainly regard the severer exercise of mountain-climbing as hazardous in the extreme in organic cases, and only to be approached by easy gradations, to be carefully supervised in any case. Gentle, largely passive, but always carefully regulated exercises will, if unaccompanied by excitement, prove of the utmost value.

ORGANIC CARDIAC DISEASES.

Pathology.—It is customary in works on pediatrics to rest content with the statement that the pathologic changes do not differ from those observed in adults, but as the early periods of life so often mark the inception of these dangerous morbid processes, a concise review of the morbid anatomy will not be amiss.

Sturges is inclined to speak of **carditis**, believing that in severe cases the morbid changes are not confined to the endocardium or pericardium, but that these structures share with the heart muscle in a common pathologic process. As Crandall remarks, however, "these cases (of Sturges') came to autopsy," and we can not feel certain that such diffuse lesions exist in most cases. Certainly disease of one or the other structure usually predom-

inates, just as the croupous pneumonia will far outweigh the small amount of pleuritis that accompanies it.

Pericarditis.—Pericarditis is an inflammation of the serous covering of the heart and of its reflection on the inner surface of the pericardial sac. We may divide this into plastic pericarditis, pericarditis with serous or purulent effusions, and adherent pericarditis. The changes involved may be only different stages of one morbid process. On the other hand, plastic pericarditis may subside without other changes. Effusion may come on insidiously. Purulent pericarditis probably partakes of a purulent nature from the very onset. Adhesions may result in essentially chronic cases, in which there has been no suspicion of the process.

In plastic pericarditis the internal or external surfaces of the membrane may be affected, and the changes local or general. In the mildest cases the membrane is red, sticky, and devoid of luster, the latter due to a light coating of fibrin. The fibrin may be present in such large amounts that the "hairy heart" (*cor villosum*) is produced. Some serous exudate is always found between the meshes of the fibrin. Many of these cases are tuberculous, the fibrin covering the small tubercles (Osler). If resolution occurs in this plastic stage, white spots are seen occasionally to dot the serous surface. The exudate may be simply serous, containing flocculi of fibrin and endothelial cells. This is the common form of effusion in rheumatic endocarditis. Again, the fluid may be purulent, either because of extension from the contiguous mediastinal glands or pleura, as a manifestation of a pyemic process, or as a primary occurrence (local tuberculosis). When the fluid is bloody, the probabilities are that the affection is tuberculous. It will readily be seen that the rôle of the microorganism in pericarditis is a most important one. (See Endocarditis.)

Adhesions may form between the two surfaces of the membrane (local or general), or extrapericardial adhesions may be present.

Myocarditis, an inflammation of the muscular tissue of the heart, results whenever pericarditis is well marked. For a depth of two to three millimeters the muscle may appear quite pale (Osler). Affections of the cardiac muscle in childhood have not been well studied. One need scarcely more than allude here to the common forms of dilatation and hypertrophy, whether these lesions occur independently or are accompaniments of valvular, pericardial, kidney, or pulmonary disease.

In pneumonia and diphtheria cloudy swellings may be found,

and in typhoid fever a true myocarditis may be present. Tubercle and syphilis rank as uncommon affections.

Sarcomata of the heart are exceedingly rare.

Endocardial changes may also accompany the aforementioned process, or occur without either. Micro-organisms may be found in lesions of the lining membrane, and yearly their number is increasing. We quote the following list from Wilson, though it is by no means exhaustive: Streptococci, staphylococci (aureus, albus, cereus albus, flavus, nonpyogenes), the bacillus typhi abdominalis, bacillus tuberculosis, bacillus diphtheriæ, bacillus pyogenes fœtidus, bacillus of anthrax, the micrococcus lanceolatus, the gonococcus of Neisser, the diplococcus pneumoniæ. In many of the cases of ulcerative endocarditis the gonococcus has been isolated from the valvular granulations. We regard the list as very important, for much of it is direct evidence in favor of the infectious character of acute articular rheumatism, and tends to show the protean nature of that disease. Inflammation attacks most frequently the valvular endocardium; in intra-uterine life the tricuspid, and in post-natal existence the mitral, leaflets being the preferred sites of disease.

The changes resulting are spoken of as verrucose (warty), ulcerative, or sclerotic; but, as in pericarditis, we can draw no sharp pathologic or clinical lines.

The changes occur two to three millimeters from the free margins of the leaflets (Osler)—*i. e.*, at the lines of maximum contact (Sibson). In the verrucose (warty) form small bead-like bodies or larger granulations are observed. These represent newly formed vascular tissue infiltrated with endothelial cells and capped by cellular débris and fibrin. Micrococci are present in ulcerative forms (Eberth and Klebs), but are known to bear no constant relation to the simple forms. These changes commonly pass into a sclerotic phase, with the tendency to contraction noticed in scar tissue generally. Should the deformity resulting narrow the valve orifice and offer resistance to the normal flow of blood, we speak of stenosis; should the valve leaflet fail to meet its fellows in closure, back flow or regurgitation would occur. Sclerosed valves are likely to be the seats of recurrent inflammations.

More rarely, indeed very rarely in childhood, the warty granulation undergoes rapid disintegration, the necrosed tissue is swept away, and ulceration or malignant endocarditis manifests itself. Such an ulcer may completely perforate a valve. Emboli are sometimes carried along into the circulation in the various

forms of endocarditis, and the resulting phenomena observed in distant parts will vary according to the structures involved and the septic or nonseptic characters of the débris.

DISEASES OF THE PERICARDIUM.

PERICARDITIS.

Inflammation of the serous envelop of the heart may occur, with or without muscular or endocardial involvement. It is properly considered a disease of the heart. Large effusions are more likely to occur in children than in adults.

Etiology.—Pericarditis is rarely primary, though it is true that the pericardium may be wounded from without, and that foreign bodies may ulcerate from the esophagus into the sac.

Rheumatism is the most frequent cause of secondary pericarditis, and the rheumatic affection may be so slight as to escape attention; the effects of the poison may be expended upon the pericardium instead of on the joints. Septic infection of the umbilicus ranks as a prominent cause in early infancy. Tuberculous forms of pericarditis are much more common than is usually supposed. Scarlet fever, typhoid fever, diphtheria, and measles are occasionally the essential factors, and cases following influenza are reported, but it is difficult to exclude antecedent lesions. Pericarditis may be met accompanying or following many grave affections.* Extension of inflammation from contiguous organs occurs in a number of cases (pleuritis, mediastinal abscesses, pleuropneumonia).

Pericarditis may occur at any age, and males are more frequently attacked than females.

The bacteriologic findings in pericarditis are the bacterium coli, streptococci, staphylococcus, and rarely the bacillus pyocyaneus. It is common to find it accompanied by endocarditis.

Symptoms.—The forms of pericarditis are acute and chronic; these are again divided according to the nature of the inflammation into simple, fibrinous, or plastic inflammation and inflammation with effusion. The lesions are further described as dry pericarditis, when the inflammation results in the output of little

---

* Baginsky met with pericarditis purulentia in phlegmonous erysipelas, grave forms of angina, caries of the ribs, fibrinous pneumonia, bronchopneumonia, gastroenteritis, furunculosis, phlegmon of the throat, and empyema.

or no fluid, or it is absorbed, leaving behind fibrinous bands; also purulent pericarditis, when the fluid is infected by pus from any source. Very frequently in *plastic pericarditis* the condition is not suspected during life. Pain referred to the precordia or to the xiphoid cartilage may or may not be present. There may be left pleurothotonos—a bending of the body to one side. The pulse is usually free and rapid. Slight fever is common, and a hacking cough is often present. If effusion should form in any considerable amount, sharp or stabbing pain may be complained of, or the patient simply experiences a sense of discomfort in the precordial region. Here tenderness at the lower sternum may be coupled with the pain. Dyspnea is common, and should always demand a careful examination of the heart and lungs. The face may be dusky and the expression anxious. The patient is restless; the pulse is rapid, small, is sometimes irregular, and the pulsus paradoxus (failure or weakening of the pulse during inspiration) may be observed.

Pressure on the recurrent laryngeal nerve, when present, causes aphonia, or the left lung may become physiologically hampered from the pressure exerted.

Syncope, hiccup, insomnia, and low delirium are present in the severer cases; or marked cerebral symptoms may manifest themselves in the hyperpyrexia of rheumatic sufferers.

Effusions may come on insidiously, and with practically no symptoms; if abundant, cyanosis and orthopnea may be graphic features.

In adherent pericardium the symptoms are uncertain and indefinite. The affection may not be suspected until a careful physical examination demonstrates great cardiac enlargement.

Physical Signs.—*Inspection* reveals an overacting heart in the plastic form of pericarditis. When effusion takes place, the precordia bulges, the intercostal spaces become prominent, and edema of the thoracic wall may be observed (especially when pus is present). The displaced viscera of the abdomen may produce a prominence in the epigastrium. Systolic retraction at the apex, diffusion of the apex-beat, and Friedreich's sign (diastolic collapse of the cervical veins) are of diagnostic importance in adherent pericardium. Much more important than retraction anteriorly is the posterior retraction described by Broadbent and known as "*Broadbent's sign.*"

Palpation may reveal a distinct friction fremitus in simple pericarditis, most marked on the right ventricle, about the fourth interspace, and best felt as the patient leans forward. As effusion progresses the cardiac impulse becomes weakened and finally

lost. The apex-beat seems displaced upward and outward, though this is probably apparent and not real. At the same time the pulse may be quite forcible. Fluctuation can rarely, if ever, be detected. When adhesions form, systolic retraction can in some instances be felt at the apex, and a diastolic rebound may follow it.

Percussion.—In simple pericarditis or commencing effusion we can expect to find nothing but dullness on percussion. As the fluid exudate increases the precordial area of dullness becomes much enlarged, assuming a pear-shaped type with the base directed downward and its apex toward the manubrium, the reverse of normal. Rotch lays great stress upon the enlargement to the right of the sternum, considering this diagnostic. Sansom finds a small posterior area of dullness important.

Auscultation.—Most pathognomonic of plastic pericarditis is the friction sound. It is a to-and-fro or double sound, corresponding to systole and diastole, but outlasting these periods. Its superficial character is distinctive. The sound usually exhibits a rubbing or grating quality, but may simulate the creaking of new leather (*bruit de cuir neuf*). It is usually present over the right ventricular area, but may be noticed at various sites. It may simulate certain valvular murmurs, but does not follow the laws of transmission. When fluid appears in quantity this sound usually disappears, or is heard only in certain limited areas. With the absorption of fluid it may reappear. In large effusions auscultation over the left lung may reveal feeble or tubular breathing.

In chronic adhesive pericarditis a loud systolic murmur may lead to an error of diagnosis. On the other hand, murmurs are sometimes absent. The fetal rhythm is heard when marked dilatation is present.

The pleuropericardial friction is a duplex phenomenon in which altered sounds accompany the respiratory as well as the cardiac movements.

Diagnosis.—In cases of frank articular rheumatism, where the heart is examined daily, the onset of pericarditis should not be difficult to recognize. But rheumatism is so frequently insidious in the child that this cause may not be traceable. Pericarditis complicates other affections, and as the pericardial inflammation may give rise to very little disturbance, the affection is often overlooked. When effusion is excessive, or when extensive adhesions cripple the heart, the diagnosis may be most obscure.

Cardiac dilatation or hypertrophy or enlargement of the heart from any cause may be most difficult to distinguish from peri-

cardial effusion. In the course of time the Röntgen rays will prove of the greatest value in the differentiation of these two conditions. A weak or absent apex-beat, coupled with a strong pulse, should strongly suggest effusion. Again, the shape of the dull area is of great importance, being increased in all directions—in the majority of instances in the form of a pear.

In dilatation the impulse is visible and wave-like; it is scarcely visible in pericardial effusion.

The double murmur of aortic valve disease may simulate a friction sound.

The systolic murmur in adhesive pericarditis may be difficult to distinguish from a valvular murmur. A study of transmission and quality of sounds over various portions of the chest will here enable us to differentiate. Lastly, certain cases of massive effusion may be most difficult to diagnose, as they simulate, even to the tubular breathing, left-sided pleural effusion.

When purulent pericarditis is suspected, diagnostic puncture should be performed. A temperature-range peculiar to a purulent process and a study of the blood would assist the observer.

Prognosis.—This depends largely upon the etiologic factors and upon the amount of effusion and whether it is serous or purulent. In rheumatic pericarditis the immediate outlook is usually good, though these cases with large effusions may die suddenly or the heart be subsequently crippled by adhesive bands. In septic or purulent pericarditis the prognosis is most gloomy. Tuberculous pericarditis, though slower in its course, also terminates fatally.

Treatment.—In acute pericarditis the child must be kept at absolute rest in bed, and free from all psychic or other disturbances. This condition of physical and mental quiet must be maintained for weeks or months. Locally, dry cold should be applied, as this suffices to lessen the cardiac rate and vascular pressure. Heat (dry or moist) may supplement this with much comfort and advantage at certain times. The diet should be simple and concentrated, peptonized foods being demanded where there is gastric disturbance; all gaseous distention must be promptly relieved. The systemic treatment will depend somewhat upon the accompanying and causative affection. In rheumatism alkalies combined with the salicylates should be given, unless there is great depression. In septic conditions active stimulation is demanded in spite of the pericardial complication. Morphin is the stand-by to relieve pain and great restlessness, though phenacetin in small doses may be useful in mild cases, and chloralamid or sulphonal will control restlessness when opium is not demanded. When

the inflammation subsides and the effusion appears upon the increase, small blisters applied over the precordia at intervals of seventy-two hours are occasionally very useful. Calomel, alone or combined with Dover's powder, is a valuable agent here. A dose or two of a saline laxative is often most useful in robust children or sthenic patients. Potassium iodid is recommended in this affection. Caffein, spartein, or diuretin will find use in certain cases. Digitalis, strophanthus, and convallaria are to be used only when there is marked cardiac weakness. It is well to begin with aromatic spirits of ammonia before using the more powerful cardiac tonics.

In massive effusion paracentesis should be performed, either in the fifth interspace, slightly to the left of the sternum, or, as Rotch suggests, to the right of sternum. In serous effusion aspiration will prove sufficient, but where pus is suspected, a surgeon should always be called, and in this grave affection we can not regard any hopeful operative measure as too radical. Epileptiform seizures or choreiform movements may appear during the operation of paracentesis.

OTHER AFFECTIONS OF THE PERICARDIUM.

Hydropericardium—a collection of water within the pericardium—in the child is quite rare; it is most likely to occur in kidney disease, and more rarely (unaccompanied by other dropsical symptoms) it is observed after scarlet fever.

Hemopericardium (blood within the pericardium).—The productive factors of this condition in adult life do not obtain in the child, though, as already mentioned, tubercle may be accompanied by sanguineous pericardial exudate.

Pneumopericardium—air within the pericardium—may be produced as in the adult, and differs in no way from the condition observed in adult life.

AFFECTIONS OF THE MYOCARDIUM.

Causes.—Hypertrophy and dilatation usually occur conjointly, and may result from excessive cardiac activity *per se*; mechanically, from extracardiac adhesions or as compensatory efforts in valvular disease. Nephritis is a cause of left ventricular *hypertrophy*. (See Fig. 36.)

Symptoms of myocarditis can scarcely be separated from

those of accompanying inflammatory conditions. *Excessive dyspnœa, cyanosis*, and *palpitation* would render that diagnosis probable. Dilatation and hypertrophy may or may not be accompanied by symptoms. When the former condition far exceeds the latter (*dilatative hypertrophy*) circulatory phenomena

FIG. 36.—ACUTE PARENCHYMATOUS NEPHRITIS AND HEMATURIA, SHOWING DECIDED LEFT VENTRICULAR HYPERTROPHY; AREA OF DULLNESS OUTLINED BY AUSCULTATORY PERCUSSION.

arise, which will be recognized as evidences of failing compensation.

In syphilis or tubercle we should expect to find other features or signs characteristic of one or the other disease.

MYOCARDITIS.

Myocarditis, if we are to form an opinion from the various textbooks, would seem to be one of the rare diseases of childhood. Judging from the observations made at autopsies, where, indeed, most of our knowledge of the pathology and theory of the disease is obtained, it is much more frequent than is generally supposed, and, while an important factor in the symptomatology of

infectious diseases, it is not so fatal as the literature on pediatrics would lead us to infer.

Myocarditis is an acute or chronic inflammation of the muscular structure of the heart. The chronic form is always found in adults and associated with sclerosis, and therefore will not be discussed here.

Causes.—Myocarditis is either primary, when due to diathetic dyscrasias—such as congenital syphilis, tuberculosis, or rheumatism; or secondary, when due to endocarditis, pericarditis, toxins from the infectious fevers, or poisons, like lead, arsenic, or phosphorus. It may be of traumatic origin. Boys are much more liable to be affected than girls.

Pathology.—Macroscopically the heart muscles are pale, soft, and friable; microscopically, changes are found in the parenchyma: cloudy swelling, fatty infiltration and fatty degeneration, with an invasion of the connective tissue by leukocytes. The whole structure of the heart is not always affected, and some portions of the cardiac tissues may be quite normal, while others have become degenerated. The myocardium is peculiarly susceptible to the toxins of infectious fevers; the fever and the disease itself may seem to play but a subordinate part in fatal cases. This is particularly true in diphtheria and pneumonia, where the severity of the toxemia may bear no or only a small relation to the apparent mildness of the disease. Autopsies in diphtheria, pneumonia, scarlatina, and typhoid fever constantly show sufficient myocardial changes to have caused death. When cloudy swelling and fatty infiltration have occurred, complete recovery may follow, but when further degenerations have invaded the tissues, permanent injury results. The former conditions are constantly found in the infectious fevers.

Symptoms.—The symptoms of myocarditis are apt to be lost sight of in the care of the primary disease, if indeed any are present. Some of the most serious cases of myocarditis have been evidenced only by the sudden death of the patient. When, however, faintness, cyanosis, vomiting, dyspnea, and precordial pain or distress, together with a weak, rapid, irregular heart action, with a feeble impulse and weak sound, are present, it is certainly significant of myocarditis, and should be suggestive, especially when associated with or following upon the infectious fevers. In these cases again we find the ratio of the pulse and respiration distorted. Dilatation and hypertrophy may or may not be accompanied by symptoms. When evidences of failing compensation, with its attending circulatory phenomena, arise, eccentric hypertrophy can be recognized.

Diagnosis.—The diagnosis of myocarditis is most often made first at the autopsy. A positive diagnosis during life is generally impossible, but should always be suspected in the infectious fevers, when the cardiac symptoms, before mentioned, are present, especially so when pericarditis and endocarditis can be excluded.

Treatment.—Absolute rest should be insisted on, especially following severe attacks of the infectious fevers, when myocarditis is almost always a coexistent condition. The patient should be kept in a recumbent position for several weeks, and prevented from making any sudden exertion, which might prove fatal. Cardiac stimulants like ammonia, alcohol, caffein, strychnin, and iron should be given. Digitalis should be used with caution and only when evidences of muscular failure are plain. When symptoms of heart failure appear, morphin hypodermically may be administered with gratifying results. Syphilitic and tubercular myocarditis demand appropriate treatment.

Sequelæ.—Those cases where cloudy swelling or fatty infiltration only has taken place may go on to a complete recovery, when the heart tissue resumes its normal condition. In extreme cases, where the toxemia has been intense, heart failure may terminate the case; but when fatty degeneration has occurred, where the proper nutrition of the heart muscle has been interfered with, there is a permanent structural change. This results in a hypertrophy and dilatation, and may even proceed to an aneurysm or rupture of the heart.

Acute suppurative myocarditis, or abscess of the heart, is a rare condition in adults or children. When seen, it is due to a phlebitic or pyemic origin.

Cardiac aneurysm, while not always, is generally due to a true myocarditis, and its favorite point of election is the left ventricle. It may reach a considerable size. Embolism into the coronary artery may lead to this condition by causing a necrosis of the tissues. It is extremely rare in children.

DISEASES OF THE ENDOCARDIUM.

ENDOCARDITIS.

Synonym.—VALVULITIS.

Causes.—Rheumatism is by far the most frequent cause of endocardial inflammation. Chorea is frequently accompanied by endocardial change, but here again the underlying cause is

probably rheumatism in the majority of cases. Septic conditions give rise to endocarditis. Pneumonia and pleuritis are frequent causes. Scarlet fever is too often complicated by endocarditis; and diphtheria, measles, typhoid fever, and variola rank as occasional causes. Tuberculous endocarditis occurs. Endocardial changes may accompany acute or chronic nephritis. Carcinoma is so rare as scarcely to demand mention. Lastly, endocarditis

FIG. 37.—GIRL AGED ELEVEN YEARS; DOUBLE MITRAL DISEASE, AREA OF DULLNESS GREATLY INCREASED, ESPECIALLY OVER THE LEFT VENTRICULAR REGION.

recurrens, rather a frequent affection, is worthy of attention. According to Crandall, girls suffer from rheumatism and consequent valvulitis much more frequently than boys. Endocarditis *may* occur in utero, but is rare under five years.

Clinical History.—Acute endocarditis maybe cured—"really cured" (Jacobi)—in the child, but too often the acute inflammation ends in the sclerotic changes previously described, and we

have the crippled leaflets of chronic valvular disease. This may never cause any inconvenience in the subject affected, for the muscular walls of the chamber or chambers, which must stand the brunt of strain, undergo a true hypertrophy.

Thus, in partial obstruction at the mitral valve we should expect left auricular hypertrophy. In regurgitation at the same orifice the left ventricular wall would share in the enlargement, for it must now exhibit force enough to send an increased amount of blood in two directions. This same ventricular wall would hypertrophy in the common combined lesion at the aortic valve. Where such hypertrophied muscle adequately performs its increased task, *compensation* has been effected. Now, if the heart muscle of the left side fails to compensate fully, the strain comes upon the pulmonary system of vessels, and certain lung symptoms arise. The next tissue affected would be the right heart; and, lastly, the strain would manifest itself in back pressure upon the venous system. Fortunately, compensation is very readily effected in the child, and so even in grave endocarditis children may thrive surprisingly. We must not forget, however, that *recurrent* inflammation is common, and that during such recurrence some acute disease or physical strain may serve as the immediate determining factor of *failing compensation.*

Practically, then, we have three clinical stages of endocarditis: (1) Acute inflammation, which may terminate in recovery, death, or chronic valvulitis; (2) compensation (in chronic valvulitis); (3) failing or lost compensation.

Symptoms.—The symptoms of acute endocarditis may be obscure or wholly wanting, so that a diagnosis is not made until permanent damage is done. When it arises in the course of an acute disease, as articular rheumatism, the temperature rises slightly (1° to 2° F.), the pulse-rate is increased, and the child is restless, with anxious expression. Pain and palpitation are rarely experienced. Cyanosis may appear, especially if the myocardium become involved (*vide supra*). The occurrence of fibrous nodules around joints is suggestive, though not pathognomonic. Advanced symptoms are seldom seen in the first attack. However, there are certain grave cases of rheumatic endocarditis which are attended by high fever, marked constitutional symptoms, and hemorrhages, thus making one think of ulcerative endocarditis (Litten). Lastly, ulcerative endocarditis itself is usually accompanied by marked cardiac disturbance, by a typhoid state, by purpura and hemorrhage from mucous membranes, and by the presence of embolic abscesses in various parts of the body. Fortunately, this fatal disease is rare in childhood.

If, to meet the damage done, compensation is fully established, chronic valvular disease may be devoid of symptoms; but if compensation should be imperfect, some of the following symptoms are liable to be present: *Dyspnœa* and *palpitation* are most common in aortic disease; *pain* is rarely present, except in mitral stenosis; *typical ascending edema* is almost never seen in children, although *pulmonary congestion* is common enough; *epistaxis* is far from rare; *subacute bronchitis* and *persistent cough* are frequent accompaniments of chronic valvular disease. *Cyanosis* and *venous stasis* especially accompany mitral regurgitation.

Physical Signs.—Acute endocarditis is usually diagnosticated by the physical signs. Inspection shows a rapid and diffuse cardiac beat. Palpation confirms this observation, and may reveal a strong, somewhat jerky, or irregular pulse (*pulsus celer*). Percussion is at first negative, unless some preceding disease of the heart has induced a change in its volume. The signs of dilatation appear sometimes with astounding rapidity. On auscultation we may hear, usually at the cardiac apex, a large blowing systolic murmur or souffle. When we remember that the localized damage may be exceedingly insignificant, we are not surprised that physical signs occasionally fail us. Osler styles these signs "notoriously uncertain." In severe cases of ulcerative endocarditis, however, the physical signs are likely to be accentuated.

In chronic valvular disease a careful and judicial study of physical signs is of the greatest diagnostic and prognostic importance. We have outlined certain limitations in the study of these conditions in an early chapter; we will speak of others now, but these need not discourage us from carefully studying every case. The research is a more difficult one in children than it is in adults, but it is still a fruitful and imperative quest. We have no more patience with the diagnostic Nihilist than with the therapeutic brother of the same negative type. The tools at hand are simple and effective in each instance; one has simply to acquire a practical knowledge of their judicious use.

We shall exclude *pulmonary stenosis* from our consideration here, as it is almost invariably a congenital affection, and has been described as such. There remain for our study mitral regurgitation, mitral stenosis, aortic regurgitation or double aortic disease, and tricuspid regurgitation.

Mitral Regurgitation or Insufficiency.—The leaflets of this valve suffer most frequently from endocardial inflammation, and incompetency (producing regurgitation) is the most common result.

Inspection frequently reveals a bulging of the precordia. The apex-beat appears diffuse and may be displaced downward and to the left. The cervical veins may be distended and occasionally they exhibit pulsation. *Palpation* furnishes us with our best means of locating the apex-beat, and this is usually dislocated downward and to the left (Sansom). Pulsation may be quite general and diffused, felt over the whole left ventricular area, and usually over the right ventricular region.

One should mentally note whether such pulsations are weak and wavy or forceful. A systolic thrill is sometimes present, as in any valvular affection, but thrill is much more common in mitral stenosis.

In no valvular affection does *percussion* reveal so broad an area of dullness as in well-marked mitral regurgitation. The dullness extends to the left, beyond the nipple-line, possibly to the axilla, and to the right as far as the right sternal border or beyond it. But percussion should not be performed to ascertain the *size* of the heart alone ; percussion reveals most when it informs us of the sizes of the various chambers of the heart (Sansom). Thus we are led inductively to the study of *auscultation*, which, though our most nearly perfect method of exploration, is often but confirmatory of what the other procedures have already made clear. Now, murmurs are not always present in valvular disease, but, on the other hand, most murmurs in childhood are organic. One must study the point of *greatest intensity* very carefully, for the child's chest is so small that sounds are often widely diffused. The murmur of mitral regurgitation is almost invariably systolic in time, and the sound continues throughout the systole. It is heard best at the apex, though occasionally the base or midsternum may present the loudest sound. It is transmitted to the axilla and to the left scapular region. The quality may vary from a soft cooing murmur up to a harsh rasping or sawing character. We have plainly heard this murmur with the examining ear an inch from the chest. Double mitral disease is rather frequently observed.

Mitral Stenosis or Obstruction.—This affection is much less common than the foregoing lesion, though a considerable degree of stenosis may accompany regurgitation. Mitral stenosis arises in insidious forms of rheumatism (Sansom ; Crandall).

Inspection.—Pulsation may be observed over the upper chest upon the left side. Osler states that this is due to right ventricular hypertrophy, no matter how far upward and to the left it may extend. The apex appears normally situated or is removed but a short distance from its usual site.

Palpation reveals pulsation over the left auricular area and over the right heart. An apical presystolic thrill is quite common. This may be present at certain times and not at others. It is usually accentuated by an upright or bending forward position. In well-marked instances this sign is practically pathognomonic. *Careful percussion* reveals dullness, extending to the right and in an upward direction to the left of the sternum. Hypertrophy is seldom so marked as in double mitral disease or mitral regurgitation. The murmur of mitral stenosis is absolutely characteristic. It is of short duration, occurs during the presystolic or later diastolic period, becomes rapidly intensified, and ceases with the systolic impulse. It corresponds in time to the described thrill. It is best heard at the apex or in the fourth interspace above. Ordinarily it is not transmitted to any degree, though Griffith has observed cases where this murmur was heard in the axillary region and back. Our studies have confirmed the statement that the area of the murmur is singularly restricted. Gallop or fetal rhythm is rather common in mitral stenosis. Accentuation of the second pulmonic sound is almost invariably present. The murmur described above is singularly inconstant: it may be present at one time and not at another, so that too much prognostic expectation should not be founded upon its disappearance.

Disease of the Aortic Leaflets.—As alcoholism, excessive and continuous muscular strain, and acquired syphilis are rarities in childhood, the etiology of aortic disease must differ essentially from that of the adult. Excluding congenital cases, the disease is almost invariably due to rheumatism.

In **aortic regurgitation** or **insufficiency** inspection reveals the apex dislocated to the left and to a low point in the thorax. The apex has appeared as low as the eighth interspace in this disease. The precordia bulges markedly in the young child, especially over the left ventricular area. The arteries in the neck are seen to throb violently, and the brachials often plainly exhibit the phenomenon. Even the radials appear to fill and empty alternately and most rapidly.

Corrigan or Water-hammer Pulse.—The capillary pulse is another phenomenon of aortic regurgitation. The ophthalmoscope reveals pulsation of the retinal arteries. Palpation confirms the suspicion of a downward dislocation of the apex-beat, and probably a throbbing sensation can be perceived over all the precordia. A thrill at the aortic cartilage or in its vicinity may be felt. The pulse is of the Corrigan or "water-hammer" type; this is made more pronounced by elevating the arm. Percussion reveals

a much enlarged precordial dullness, both absolute and relative, and the increase in the longitudinal diameter predominates over the lateral increase. (See Mitral Regurgitation.) The left ventricle may be alone affected, or all of the cavities may suffer alike from dilatation and hypertrophy (*cor bovinum*).

On auscultation over the affected heart one hears a diastolic murmur at the aortic cartilage (second right interspace). The sound is usually a soft bruit, long drawn out. Frequently it completely replaces the valvular click of the sound, though this is not always the case. It is transmitted down the sternum or toward the apex. A sharper murmur, systolic in time, may precede the regurgitant murmur, and is probably produced by roughening of the leaflets; for in these cases the valve orifice is so dilated that stenosis is out of the question.

Double Aortic Disease.—While regurgitation is not always accompanied by stenosis, yet marked stenosis is probably accompanied by leakage in every instance. Thus we deem it proper to speak of double or combined aortic disease. Of course, one or the other of the conditions may preponderate. Marked stenosis is exceedingly rare in childhood except as a congenital lesion. It is scarcely necessary to mention that we may have a combination of aortic, mitral, and tricuspid disease.

Inspection.—The apex-beat may be somewhat displaced, but not nearly so much as in the regurgitant lesion.

Palpation.—A somewhat forceful and disseminated beat is usually felt. A *thrill*, systolic in time, is decidedly characteristic. It is very marked over the base of the heart or at the aortic cartilage.

Percussion shows slight enlargement of the left ventricle (concentric hypertrophy), and mayhap also involvement of the right heart.

Auscultation.—Unless the systolic murmur is exceedingly shrill and harsh; unless it is heard best at the second right interspace and is transmitted into the large arteries of the neck and axilla, we can not be certain of aortic stenosis. The diastolic murmur is not always present. In a case recently seen at the Polyclinic Hospital the aortic sound of closure was perfect and there was no murmur in diastole. Sometimes a typical to-and-fro murmur is heard. (See Aortic Regurgitation and Pericarditis.)

Tricuspid Disease.—Regurgitation is the only lesion worth considering, as stenosis is nearly always congenital and the patients thus affected soon die. Regurgitation at this orifice is primarily due to involvement of the left heart or to pulmonary disease, the right side suffering secondarily. It may occur in

chronic bronchitis or in congenital bronchiectasis, and is accompanied by systolic pulsation of the cervical veins and pulsation of the liver. Signs of right cardiac hypertrophy are demonstrated by percussion.

Auscultation.—The murmur is heard near the lower portion of the sternum, and is soft in character and systolic in time. It may be impossible to distinguish it from the murmur of mitral regurgitation.

Diagnosis.—If in every case of rheumatism and in cases of infectious disease an examination of the heart should be made daily, the diagnosis of acute endocarditis would be secured more frequently. In pericarditis the friction sound should serve to differentiate. Cases of ulcerative endocarditis are frequently mistaken for typhoid fever; the diagnosis is sometimes very difficult, and we should endeavor to exclude all diseases with similar symptoms. (In a case at the University Hospital miliary tuberculosis simulated ulcerative endocarditis.) In cases of chronic heart disease physical signs, carefully weighed, will serve us in most cases. We must not rest content, however, with the diagnosis of a lesion, but must also appreciate the ratio between hypertrophy and dilatation, and must study carefully the general condition of the patient.

Prognosis.—In acute endocarditis the prognosis is usually good. In the severe recurrent types we must judge of severity by the amount of myocarditis and the intensity of the symptoms that have been detailed. In ulcerative endocarditis the prognosis is absolutely gloomy.

In **chronic cardiac disease** the quasi-scientific man blunders most miserably. Let him not assume that the presence of a heart murmur is necessarily of dark portent, nor that it should be used as a bugbear during the remainder of the patient's existence. Judge carefully of the amount of enlargement of the heart; try to estimate whether hypertrophy is present to a compensatory degree. Above all, do not forget that one is called upon to pronounce an opinion upon a patient and not upon a heart. Recurrent rheumatic attacks, poor hygienic surroundings, lowered nutrition, puberty, etc., are damaging factors. On the other hand, the maintenance of perfect nutrition and of perfect cardiac compensation may obtain for many years. The outlook, in the presence of good general conditions, is almost always bright for the child. It will be most unfavorable in aortic incompetency, especially if failing compensation be present, somewhat better in mitral stenosis, best in mitral regurgitation.

Treatment.—In acute endocarditis our first effort must be directed toward minimizing the amount of work done by the affected heart. Perfect rest to body and mind is, if anything, of more importance than in pericarditis. The child should be placed in bed and kept there, unless excessive fretfulness forbids, when the nurse's arms or a comfortable lounge may serve in good stead. The diet should be light, digestible, and given in small amounts and at rather frequent intervals. Milk will prove the best food. If it produces flatulency, predigestion or dilution or both should be employed.

Acute diseases of the heart, as a rule, are inflammatory; but not always. In many conditions where the cardiac disease is a frequently occurring complication, as in diphtheria, the danger is from a parenchymatous myocardial degeneration. This is true also in children during attacks of the exanthemata, in pertussis, and in pneumonia. Here the deaths are due primarily to the involvement of the heart muscles, which are sometimes fatally weakened by the toxins of these infections without giving any discoverable signs of carditis. In them, too, a specific softening and consequent destructibility or acute structural dilatation of the myocardium generally takes place, which may be only, or best, revealed by percussion. Evidences of a general failure in the circulation must not be overlooked. Overexertion after the continued fevers is a fertile source of cardiac damage of the same character as that following prolonged and severe strains upon the normal heart.

In inflammatory cardiac conditions there is great excitement of the heart; the muscle is in ceaseless activity, and during this period it is doing twice as much work as in health; hence every effort must imperatively be made to maintain absolute rest of mind and body in every form of carditis.

It is clear that at this stage no tonic medication is of use, but only quieting agents are indicated. If pain is present, clearly evidenced or to be elicited by pressure under the left costal arch, along with hurried breathing, rapid pulse, disturbed rhythm, with or without murmurs, the treatment should be external applications which will give comfort and quiet to the heart, such as hot poultices of linseed meal, to which may be added laudanum or belladonna. Local blood-letting by leeches applied to the sternal notch, thus causing a reflex nerve sedatation, produces much relief in older children. The ice-bag to the chest will prove a useful local measure, especially if pain is present. When the heart is acting well and good compensation has been established, as shown not only by the normal position of the

apex-beat but also by the absence of signs of backward pressure in the lungs, liver, etc., drugs that would further stimulate the heart are obviously harmful. If the physical signs are not associated with any evidence of failure of the cardiac muscles, the effect of routine treatment by digitalis upon the heart would be to drive the myocardium to increased effort; the endeavor of the right ventricle to force the blood through the lungs more rapidly might possibly lead to hemorrhage from the pulmonary capillaries, and the left auricle as well as the right ventricle would probably further dilate.

Treatment should be directed to the maintenance of the balance in the circulation by judicious advice as to the manner of life to be led and the attention to the general health. The heart should be carefully examined at intervals, especially when any signs of downward progress, such as increased or increasing dilatation or engorgement of the liver and lungs, begin to make their appearance. If, however, these symptoms show themselves, now is the time of all others that drugs of the digitalis group are indicated and form a necessary factor in the treatment. As a preliminary to the use of digitalis a free purgative is very useful, and leeches to the precordia, or even venesection, may with advantage be resorted to when there is cyanosis. The effect of these remedies upon the heart and circulation should be carefully watched. When larger doses of digitalis are called for, it is well to restrict the patient to the recumbent position.

There is a most intimate vasomotor association between the nerves which contract the blood-vessels of the viscus and the cutaneous nerves of the corresponding skin area thereabouts (W. H. Thomson).

Systemically, in rheumatic cases we should use the salicylates alone or combined with alkalies—strontium salicylate is perhaps the best. These should never be used long at a time,—not over two or three days continuously,—for it is quite generally recognized that endocarditis is an incident and not a complication in the course of rheumatism. Jacobi lays great stress upon the use of potassium iodid. Phenacetin is also a helpful drug, and, aside from its effect upon the fever and pain, is probably antirheumatic. The bromids are useful to control restlessness. In serious cases, attended by great pain and restlessness, opium is again the remedy *par excellence*. Alcohol and cardiac stimulants are contraindicated in simple cases. The bowels must be kept rather freely open by the use of mild laxatives or enemata.

If a surface pallor with a small, rapid, irregular pulse is noticed,

it may be the result of a myocarditis and arterial degeneration due to the toxic effects of the exanthemata and diphtheria. Digitalis is then of no use, because it will not benefit the degenerated muscles, but rather requires a fairly normal muscle to work upon. Here strychnin is a far better agent, along with some alcohol. The hypodermic use of camphor is also of service; three to eight grains may be given in sterile oil to a child of five.

When the more protracted effects of an endocarditis are present, it is well to insist upon several weeks of absolute rest. There may be much relief thus afforded to the inflammatory vegetations which tend to form on the valves and flaps, by keeping the circulation as quiet as possible, otherwise there is danger of adhesions with contractions of the delicate endocardial structures.

In septic cases (ulcerative endocarditis) stimulants must be used with a free hand in spite of their local effects on the heart.

After a pericarditis it sometimes happens that the inflammation extends to adjacent structures, such as the pleura, ribs, or sternum, and adhesions result. Here mechanical measures are useful, such as strapping the left side with strips of rubber plaster, in order to limit the full force of the systole and assist in maintaining tranquillity. If there is pain also, heat or cold may be used, along with belladonna or laudanum externally.

It is in chronic heart disease that ardent therapy may carry havoc in its path. These cases should be recipients of hygienic care, as regards diet, bathing, exercise, and rest; and children should be guided into such life pursuits as will minimize the demands of physical efforts and strains. It will be well for every student to read Jacobi's sound advice in his most excellent book on "Therapeutics of Childhood." If compensation is adequate, the heart needs no drug to whip it on to increased endeavor and consequent disturbance of balance. Some member of the family who will aid us in enforcing proper hygienic and other limitations must be informed of the cardiac condition. Lastly, each case must be judged on its own individual indications, and our efforts must be largely guided by results obtained. When the cardiac balance is disturbed, once more *rest* must be enjoined. Often this masterly inactivity alone will prove sufficient to reestablish the equilibrium so necessary to secure in such cases. When cyanosis, dropsy, pulmonary congestion, or other serious symptoms arise, digitalis is by far the best drug at our command. It may be used irrespective of lesion, though it probably does best in mitral regurgitation. The infusion

is the best preparation, and may be given in doses of from twenty minims to one fluidram, or more, according to the age of the child. Strophanthus may be used where symptoms of digitalis poisoning arise or where digitalis can not be given. Spartein, caffein, convallaria, nitrites, etc., are indicated in certain cases, but they are all vastly inferior to digitalis. Digitalis may be given for weeks, or even months, until compensation is restored. Iron will prove of great value during and after convalescence. Strychnin in small tonic doses is especially useful when the myocardium is weakened. Cod-liver oil may also be of use.

There comes a time in subacute and chronic disease of the heart when carefully systematized exercises, such as breathing, posturing, and later passive and slightly active movements, are of great utility to improve the circulation and maintain vigor, both mental and physical.

CHAPTER XIII.

DISEASES OF THE RESPIRATORY ORGANS.

DISORDERS OF THE UPPER RESPIRATORY TRACT.

Diseases of the upper respiratory tract are common in children, and their early treatment is especially important, for when neglected, disastrous effects follow upon the health and development of the child.

Inasmuch as the treatment of many of these affections is largely surgical, it requires a special knowledge and training on the part of the physician. A description of the various operations and instruments would be out of place here. It will be our endeavor, however, to give a brief description of the principal affections, with general suggestions for their treatment.

Causes and Pathology of Diseases of the Upper Respiratory Organs.—In a brief article on nasal diseases of infancy and childhood it is well to confine ourselves to generalities, and to mention merely the more important causes which produce the pathologic changes in the upper respiratory tract in children, and the immediate consequences of these pathologic changes in their effect on the growth of the nasal organs, producing a change of development in the whole system of the child.

Among the chief causes of nasal disease, and particularly of nasal obstruction, are infection from any source, want of cleanliness in early life, and climatic and temperature influences, causing the ordinary acute coryza of infancy. From whatever cause, the result is a swelling of the mucous tissues and a diminution in the amount of the secretion. For this reason the solid elements seem to be more abundant, causing the ropy, tenacious, and mucopurulent character of the nasal discharges. This obstructive pathologic change necessarily interferes not only with the proper respiration, but also with nutrition of the infant, inasmuch as suckling from either nipple or bottle is impossible when the nose is obstructed. If nothing is done toward reducing the swelling and inflammation within the nasal cavities, a state

of subacute and, later, of chronic inflammation and tumefaction of the turbinates ensues, the normal development of the nasal organs is interfered with, and deformities result.

In order to understand this more thoroughly we must remember that in the new-born there are four turbinated bones on each side, and that the vertical division (septum) between the anterior nasal cavities is entirely composed of cartilage, which gradually, as the child grows older, is displaced in its posterior portion by the perpendicular plate of the ethmoid. This in its descent pushes the anterior cartilaginous plate forward, and thus produces the well-marked outline of the nose in later childhood and adolescence, which in infancy is so ill defined. At the same time with the progress of the formation of the bony portion of the septum a union takes place between the two upper and the two lower turbinated bones respectively, and consequently we have, by the time the individual has reached adolescence, two turbinated bones instead of four, as in infancy, although there may be a rudimentary projection high up in the nasal chambers which corresponds to the rudimentary fifth turbinated bone of infancy.

Together with the growth of the septum and the union of the turbinated bones the other bones of the skull and face enlarge, and it is easy to see that, as they are joined each to the other in so intricate a fashion, any lack of growth or interference with development of one bone must necessarily exert a distorting influence upon the others. It is thus that want of development of the bones forming the nasal cavities will cause a want of expansion of the dental arch, preventing space for the incisors, causing the jaw to assume a plowshare shape and the teeth often to overlap. Such want of development of the dental plates of the superior maxillary bones is always observed when nasal obstruction has been present in infancy. But it is not only the development of the face which is interfered with by obstructive nasal disease: the child is deprived not only of its nourishment, but, equally important, of its means of sustenance—namely, sufficient oxygen in the act of respiration. This deficiency of oxygen is an indirect result of nasal obstruction. It might be supposed that the child, although a mouth-breather, would be able to take in a sufficient supply of oxygen for all demands of the system; but this is not so. The nose is the true organ of respiration, because it is supplied with the necessary apparatus for warming, filtering, and moistening the air before it enters the larynx, trachea, and lungs. When, therefore, the nose being obstructed the child breathes through the mouth, the cold, dusty, and dry air impinges on the membrane of the larynx, causing inflammation and oftentimes a

hacking cough. When the air reaches the smaller bronchioles, the irritation causes spasmodic contraction of the smaller bronchi and air vesicles of the lungs, so that only a portion of the lung tissue is inflated, and comparatively little oxygen is supplied to the system. This is especially noticeable in the apices of the lungs, where the bronchioles become very small and attenuated, and it is there we look for disease of the lungs in its first stages.

But long before the lungs become diseased by the inadequate preparation of the inspired air, due to nasal obstruction, the more proximate portions of the respiratory tract exhibit disturbance. If we review the diseases of the upper respiratory tract in infancy and childhood and endeavor to trace the etiology of each one of them, we shall be compelled to ascribe the ultimate cause of each to a greater or less degree of nasal obstruction or complete stenosis. By stenosis we mean complete occlusion of the nares to both inspiration and expiration, while by obstruction is meant a narrowing of these channels, one or both, which does allow a small current of air to pass. Complete stenosis is, however, but rarely met with in infancy and childhood, and is then caused either by neoplasms filling the nasal or postnasal chambers or by a congenital malformation of the nasal bones, most frequently observed as obliteration of the posterior nares by a thin slate of bone projecting across their posterior orifices. Partial stenosis or obstruction of the nasal chambers is, on the other hand, quite frequently met with in infancy and childhood, and is due to a variety of causes. First, and most frequently observed, is the obstruction caused by temporary and, later, permanent swelling of the tissues covering the lower turbinated bones. This tumefaction of tissue may be caused by specific infection from the mother during delivery, or by exposure of the child to extreme changes of temperature, producing what is commonly called a cold in the head or the "snuffles." In addition to the swelling a thickening of the normal watery secretion of the organ results from the congestion, and, by its retention in the form of a thick, tenacious flake, adds considerably to the obstruction. It must also be remembered that the tissue underlying the mucous membrane covering the turbinates is composed of a network of blood-vessels which becomes distended and enormously enlarged by the stimulus of an inflammatory process in the immediate neighborhood. If this inflammatory process is not speedily checked and the membrane and secretions restored to their normal state, we soon have a chronic catarrhal condition and, in consequence, more or less permanent obstruction to respiration. A less frequent cause of nasal obstruction in children

is deviation of the nasal septum, which may be due to traumatism, falls or blows upon the nose, or it may be caused by the pressure of a hypertrophy of the lower turbinated body pushing the cartilage toward the opposite nasal chamber. Still another cause of impaired nasal respiration is the introduction of foreign bodies into the nose. They are usually introduced by the child itself, unknown to the parents, and give rise to symptoms of cold in the head, with copious mucopurulent discharge, which may be tinged with blood. Later the symptoms are those of hypertrophic catarrh, with the addition of an offensive discharge. The ordinary mucoid polypi which produce nasal obstruction are seldom, if ever, met with in infancy, but are not uncommon in later childhood, and, by the increasing pressure during their growth, produce in time noticeable deformity by a flattening and spreading of the upper portion of the back of the nose.

Mouth-breathing is injurious because the inspired air is not cleansed, moistened, or warmed as it is in normal nasal breathing, and the result is irritation of the mucous membrane of the pharynx, larynx, trachea, and bronchi, which is readily lighted up into acute inflammation by cold or other systemic disturbance. Mouth-breathing kept up for a long period of time results in chronic inflammation of the mucous membrane of the respiratory tract, favoring in children the formation of laryngeal neoplasms. The tonsils, both faucial and pharyngeal, suffer from the same cause, and acute inflammation and hypertrophy of the tonsils result. More serious yet is the fact that the concomitant inflammation of the upper air-passages in the exanthematous diseases is enormously aggravated by the nasal obstruction, while the irritation of the bronchioles by the dry and dust-laden air prevents its entrance into the lungs in sufficient quantities for the requirements of the system, and thus not only does the whole economy suffer, but the foundation of lung disease is often thus laid in early childhood.

On the other hand, it not infrequently happens in scrofulous children that a specific or nonspecific acute rhinitis, instead of resulting in permanent hypertrophy of the turbinated tissues, is followed by an atrophy of not only the mucous membrane, but also of the turbinated bones, and the serous as well as mucous glands embedded in the membrane. Such a condition interferes in the same degree with normal respiration, and produces pernicious effects upon the whole respiratory tract and the system at large, as does nasal obstruction. The nasal chambers become too large from the shrinking of the tissues, so that the air current can not be properly warmed in its passage, and, the glands

becoming atrophied, the air can not be properly moistened and filtered, so that we have the same conditions as in mouth-breathing. But to all this must be added the formation of large adhesive scabs in the nasal chambers, which, by their bulk, cause obstruction; by their presence as foreign bodies, irritation; and by their adhesiveness, denude the membrane of its epithelium and cause hemorrhage at their expulsion; and by their putrefaction give rise to the well-known and offensive odor of ozena. The latter fact increases the danger from this kind of nasal catarrh to the system at large, because of the volatile products of putrefaction which are carried into the lungs during respiration.

ACUTE RHINITIS.

Synonym.—CORYZA.

It is hardly necessary to describe the symptoms of this very common affection. In the beginning there is dilatation of the blood-vessels of the mucous membrane, followed by swelling of the turbinated bodies and a discharge of mucus and serum. Later the discharge becomes thicker, mucopurulent, and tends to clog the nasal passage. This condition is brought about by an invasion of the mucous membrane by micro-organisms. The vitality of the tissues may be temporarily lowered by sudden chilling. While in this state they can be attacked by the various bacteria, which are constantly and naturally present on any surface which is exposed to the air. There is no specific micro-organism of acute or chronic rhinitis. Generally the common pus-producing cocci, such as the staphylococcus citreus, aureus, or albus, as well as the streptococci, are present. Some observers have also pointed out the presence of other germs under certain conditions, looking upon them as etiologic factors in the production of acute rhinitis. These micro-organisms are the bacillus lanceolatus of Friedländer, the bacillus capsulatus of Pfeiffer, and the pneumococcus.

The general treatment in the early stage should be directed to equalizing the circulation by cardiac and nerve sedatives, laxatives, etc. Atropin in small and frequent doses—$\frac{1}{1000}$ to $\frac{1}{500}$ of a grain every hour or two—has a controlling effect on the vascular dilatation in the early stage. Locally, such sedatives as the vapor of menthol and camphor, produced by placing a few grains of each in hot water and allowing the child to inhale the steam as it arises, or menthol in olive oil or liquid petroleum, from two to five grains to the ounce, dropped into the nose, are

of service. Simple ointments applied to the nostrils also help to relieve irritation. In the case of infants, if the swelling interferes with suckling, a few drops of a 1 or 2 per cent. solution of cocain may be used in the nose before nursing. In the later stage a spray or wash should be applied to free the nose from the thick secretions. Such a wash should be alkaline, in order to dissolve the mucus, and of about the specific gravity of the serum of the blood, that it may be unirritating. A greater or less density favors osmosis and produces irritation. Dobell's solution —sodium bicarbonate and sodium biborate, of each, four grains; carbolic acid, one grain, and glycerin three fluidrams, to the ounce of boiled water—is an excellent solution and answers the purpose. Other solutions, however, in which the carbolic acid is replaced by vegetable antiseptics, such as menthol, thymol, gaultheria, eucalyptus, etc., may be employed instead. They may be applied by an atomizer, or, what answers the purpose better for young children, a small soft-rubber ball syringe.

CHRONIC RHINITIS (SIMPLE AND HYPERTROPHIC).

These are but stages of the same affection, the simple passing into the hypertrophic. Both are characterized by more or less nasal obstruction—in the former, temporary swelling or turgescence of the turbinals, shifting from one side to the other; in the latter, permanent engorgement, due to hypertrophy of the turbinate bodies. In both the secretions are apt to be thick and abundant. The cause may be repeated acute attacks or some permanent irritation within the nose, such as spurs or deviation of the septum. The indications for treatment are removal of the secretions and the reduction of the swelling and obstruction. All projections or irregularities of the septum should be corrected, and any postnasal or faucial obstruction to nasal respiration and drainage removed. In the stage before the hypertrophy has taken place an attempt to reduce the swelling by local applications (such as the following: Iodin, 3 grains; potassium iodid, 6 grains; glycerin and water, each, ½ ounce; or menthol, 3 to 10 grains in an ounce of liquid albolin or vaselin) may be made. If this fails, the turbinates should be cauterized, preferably by one of the chemic caustics, such as chromic acid or trichloracetic acid. In the hypertrophic stage cauterization by the galvanocautery or removal by the snare may be required. In both conditions alkaline antiseptic washes should be employed and the passages kept entirely clean.

PURULENT RHINITIS.

This is distinctively a disease of childhood. It may be the result of direct infection or the sequel of one of the exanthemata. The symptom is a purulent or mucopurulent discharge from both nostrils, which tends to collect in scabs around the nostrils and may become offensive. The treatment consists in cleansing washes, followed by some mild astringent, such as glycerite of tannin, half a dram to the ounce of water, zinc sulphocarbolate, five grains to the ounce of water, or alumnol, five to ten grains to the ounce; and, internally, iron and cod-liver oil.

ATROPHIC RHINITIS.

Synonym.—OZENA.

It is thought by some that atrophic rhinitis is a sequel of purulent rhinitis; by others it is ascribed to scrofula or inherited syphilis. It is, however, a distinct affection and never the result of the hypertrophic variety. Its chief characteristics are the formation of crusts throughout the nasal cavities, generally extremely fetid, and increased size of the cavities from wasting of the turbinates and membrane. The indications for treatment are cleansing, stimulation, and protection. The crusts must be thoroughly removed by spray, syringe, or cotton swab. Any of the alkaline solutions above mentioned may be used, but their antiseptic properties should be increased. Thymol, which is a good antiseptic and deodorizer in this condition, may be added to any of the cleansing washes, in the proportion of ¼ or ½ of a grain to the ounce. After all the crusts have been removed some stimulating application should be made. Nitrate of silver, five to ten grains to the fluidounce, or a solution of thymol, ten grains to the ounce, has been found efficient; after this an oily substance, preferably vaselin, either plain or medicated, warmed and sprayed into the nose, to protect the surface from rapid drying. Such treatment must be carried out by the physician at least three times a week at first. In the intervals the patient can use the cleansing wash as a spray or douche at home in the morning and evening, following it with one of the liquid petroleum preparations, with oil of eucalyptus or menthol added. The treatment must be kept up continuously until the crusts cease to form in the nose, or, at least, until the patient is able to keep the nose free from crusts. The patient, however, must continue to use some cleansing wash for a long time afterward.

CROUPOUS OR MEMBRANOUS RHINITIS.

This is not an uncommon affection in children. It is characterized by the formation of a false membrane in the nose, which can be readily detached but rapidly reforms. Constitutional disturbance is very slight. The principal symptom is nasal stenosis. Bacteriologic cultures have shown streptococcus and, in some cases, the diphtheria bacillus. Clinically, the two forms are identical. The duration of the disease is from two to three weeks. The treatment consists in the removal of any loose membrane, cleansing, and the insufflation of iodoform (europhen or nosophen if preferred) or calomel. Dilute lime-water has been suggested by McBride. Iron and bichlorid of mercury or calomel in small doses should be given internally.

SYPHILITIC RHINITIS.

The coryza of syphilis is more frequently noted in infants than in adults. Any obstinate nasal catarrh in an infant should suggest the possibility of syphilis. The children usually appear emaciated, and skin eruptions will generally be found. There are swelling of the membrane and hypersecretion, which may be purulent and bloody. In tertiary syphilis, which rarely appears before the fifth year, infiltrations of gummatous material, ulcerations,—especially of the septum,—and necrosis of bone may be found. In syphilis of the nose the treatment is very important. In infants the stenosis often prevents suckling, necessitating feeding by the spoon. Tonics are indicated, such as syrup of the iodid of iron and cod-liver oil. In the secondary stage mercurials are all-important. They can be given by the mouth or by inunction. The nose must be kept clear by antiseptic washes. Menthol in oil (5 to 10 grains to 1 fluidounce) may be used to relieve the stenosis. In the tertiary stage destruction of tissue is rapid, and the resulting deformity may be very great. Iodid of potassium should be given in increasing doses up to the limit of tolerance. Mercurials are of *no* use in tertiary syphilis of the nose. Seiler recommends the surgical removal of the infiltrated tissues to prevent destructive ulceration. Iodoform should be used locally.

MUCOUS POLYPI (EDEMATOUS FIBROMATA).

These do not occur in infants, but are not infrequent in older children. They grow from the upper portion of the nasal cavity, but by elongation of the pedicle may occupy any portion of

the nares and extend into the nasopharynx. They produce nasal stenosis and watery discharge, greater in damp weather. They do not, as a rule, cause deformity. Headache, laryngeal spasm, and asthma are often due to their presence. Polypi may be caused by disease of the accessory sinuses or by any prolonged irritation of the nasal cavities. The growths should be thoroughly removed and any underlying disease treated.

FIBROUS TUMORS.

Nasal fibromata appear as dense white or reddish tumors. They spring from the periosteum or bone. Their favorite location is at the vault of the pharynx, whence they advance into the nasal cavities, by their growth spreading the bones apart and often producing great deformity (frog-face). They should be attacked early. Electrolysis has been successful in some cases.

ADENOID VEGETATION.

There is normally at the vault of the pharynx a group of lymphoid glands called the pharyngeal tonsil. Hypertrophy of this tissue is known as adenoid vegetation or hypertrophy of the pharyngeal tonsil. This condition is most frequently found in childhood, as the lymphoid tissue here, as well as that in the fauces, tends to atrophy in later life. It is one of the most common causes of mouth-breathing in children, and a frequent source of nasal and postnasal discharge, cough, laryngeal spasm, asthma, etc. Deafness and suppuration of the middle ear may also be due to these growths. Headache, frontal or occipital, is often complained of by children afflicted with adenoids. Adenoids may be congenital, but are generally of later growth, frequently appearing after measles, scarlatina, diphtheria, or whooping-cough. A hereditary predisposition probably exists, as they are often found in several members of the same family. They are often associated with hypertrophy of the faucial tonsils and the pharyngeal follicles. A diagnosis can sometimes be made by the rhinoscopic mirror, but in young children digital examination is more satisfactory. In all cases where the growth is sufficient to cause symptoms it should be removed. Local applications have no effect on these hypertrophies.

ACUTE PHARYNGITIS.

This is usually caused by exposure to cold or dampness, especially in those already debilitated by hereditary influences or by

living in a vitiated atmosphere. There is often a disturbed condition of the digestion along with this or acting as a cause. The attack is accompanied by fever, headache, pain in the throat, coated tongue, and constipation. Examination of the fauces may show a general redness or only streaks of congestion on the lateral walls of the pharynx and the half-arches. Hot foot-baths, aconite in small and frequent doses, laxatives, etc., constitute the general treatment. Locally, mild astringents, such as glycerite of tannin, diluted, or a single application of silver nitrate, sixty grains to the ounce, followed by mild astringent gargles, are commonly employed. Wet compresses to the neck are useful and give comfort.

RHEUMATIC PHARYNGITIS.

This is characterized by but slight congestion of the membrane, but a disproportionately severe pain in deglutition. It usually occurs in rheumatic subjects and is not frequent in childhood. Antirheumatic remedies should be given. Heat to the neck and rubbing with stimulating liniments give relief.

RETROPHARYNGEAL ABSCESS (RETROPHARYNGEAL LYMPHADENITIS).

The lymphatic glands embedded in the posterior wall of the pharynx occasionally suppurate, forming an abscess most dangerous to life because of mechanical obstruction to the trachea, produced by pressure or edema, or by suffocation from a spontaneous opening deluging the air-passages with pus. It is of much importance to recognize the condition promptly, both to institute treatment, if time permits, or to meet the exigencies thus induced, and, above all, to differentiate this from simple tonsillitis, laryngeal stenosis, or impaction of a foreign body. Two varieties exist, one, the commoner, occurring in infants usually under one or two years, seldom above three; the other, rarer, resulting from caries of the cervical vertebræ, is seen only in older children.

The retropharyngeal lymph-nodes are described (Simon) as forming a chain on each side of the median line between the pharyngeal and prevertebral muscles; these undergo atrophy after the third year. The adenitis may be severe enough to produce serious local symptoms, yet stop short of suppuration; it is also occasionally associated with external cervico-adenitis.

Causes.—Children are very prone to lymphatic inflammations, especially of the cervical glands. The causes of retropharyngeal

abscess are usually specific infections, most often tubercular or influenzal or less frequently following scarlatina, measles, or diphtheria. The immediate cause is usually an inflammatory condition of the nasal or pharyngeal mucous membrane. Abscess sometimes occurs in children hitherto vigorous, but more readily in the weaker ones, subject to catarrhal affections.

Symptoms.—Abscess of the retropharynx may begin slowly or arise with alarming suddenness ; indeed, sometimes death is imminent or occurs before the trouble is, or can be, suspected. The situation is in sight on the vault of the pharynx, or low down, where it can only be felt by the finger. The swelling may be seen nearly in the median wall of the pharynx or oftener to one side. There may have been an antecedent catarrh. There may be high temperature, loss of flesh, and other evidences of an acute suppurative process—a prostration out of all proportion to the other phenomena. The first definite symptom is usually an attack of dyspnea or asphyxia, due to pressure of the abscess on the larynx. Labored mouth-breathing during sleep is usual, the head is thrown back, and there is difficulty in swallowing. The voice becomes nasal, food is regurgitated through the nose or mouth, and a squeaking cry occurs, resembling the "quacking" of a duck. The tumor sometimes shows externally. The finger in the throat will tell most by demonstrating the position, size, and consistency of the mass.

Prognosis.—Death may result by suffocation, asphyxia, or drowning by pus when the disease is not recognized early enough, and rarely may come from burrowing, ulceration of the carotid, etc. If the prostration is profound, this may cause death after the pus is evacuated. The mortality is 5 per cent.

Diagnosis.—Instances of trouble in swallowing occurring among infants with mouth-breathing or dyspnea call for examination of the throat by touch as well as inspection ; not many mistakes will then be made. Few accomplishments in examining children are more important than to acquire skill in touching the throat with an exploring finger for this or other morbid conditions.

Treatment.—If the condition is recognized early enough, relief can be obtained by hot applications, chiefly to assist the abscess in pointing ; resolution can scarcely be hoped for. When pus is evident, the cavity should be opened at once, using great care to prevent the pus from flowing into the trachea, which is best accomplished by keeping the head well forward or it may be thrown forward the instant pus is set free. It is not well to use a gag ; but this alone may cause serious asphyxia. It

is also recommended that the instrument to make the opening should be the human finger-nail in preference to a knife. We have used this on two occasions and seen it done by others with good effect. A knife is sometimes required, when the mouth should be opened and held in position with a small, narrow tongue-depressor (our device of a wire loop serves us best), and the incisions made with a short-bladed tenotome, from the side toward the median line. We can not see the force of the claims of certain surgeons who insist on the advantages of external incision, except it may be for the cases due to Pott's disease. If the abscess is large and the tissue at the side of the pharynx is involved, and especially if there is burrowing of pus into the deeper tissue, then, in order to insure proper drainage, an incision should be made in the neck and the wound and abscess cavity packed with gauze.

Retropharyngeal Abscess from Caries of the Cervical Vertebra.

This variety is rare, and seldom occurs in children under three years of age. The pus-cavity is larger, forms slowly, often for months, and is accompanied by more marked constitutional depression but less sudden changes; the swelling is oftener in the median line, and not so circumscribed. The symptoms of cervical Pott's disease usually precede, though the abscess may occur before the deformity, and external swelling is more common; on digital exploration an angular prominence may be felt on the posterior wall of the pharynx. This form of abscess may open spontaneously on the outer surface below the jaw, or lower in the neck, or the pus burrows in front of the spine; the cavity, once open by punctures or spontaneously, may refill and become a slowly discharging sinus. The treatment is incision, preferably external, and drainage. We saw a case of a boy, eight years of age, in a hospital become asphyxiated during dinner, and on thrusting the finger in the throat to extract a piece of food suspected of causing this, buried our finger in a large cavity, and a fragment of meat was withdrawn, along with several ounces of pus. Once opened, the cavity heals, as a rule, but it sometimes requires cleaning out and scraping.

TONSILLITIS.

Synonym.—Amygdalitis.

Tonsillitis is either acute or chronic. The acute conditions are divided into three varieties—the superficial, or catarrhal, which

does not differ materially from simple pharyngitis; the follicular or lacunar; and the phlegmonous, or quinsy.

Causes.—Acute tonsillitis is very common among children and is liable to occur at any age. The fact that epidemics of it occur at times points clearly to the bacteriologic origin of the disease. Certain germs have been isolated in the anginas, many of which are found normally in the mouth, and in the order of their frequency may be mentioned: the pneumococcus, diphtheria bacillus, streptococcus pyogenes, diplococcus scarlatinæ, influenza bacillus, staphylococcus pyogenes, and the tubercle bacillus. In making the cultures not infrequently is found and isolated a mixed infection of two or more of these.

A rheumatic diathesis exerts a marked influence over the anginas as a predisposing cause. Exposures to wet and cold, as to poor ventilation and unhygienic surroundings, act as exciting causes, debilitating the system, and especially the tissues of the throat, for the reception of the infections. Overexertion of the voice also prepares the soil for these germs.

Symptoms.—The symptomatology of tonsillitis is the same for the three varieties, varying in severity with the condition; thus we have pain in the throat, with difficult swallowing and articulation, the voice sounding as though the mouth were filled with some soft food. There is marked tenderness at the angle of the jaw on pressure, and usually a swelling is apparent. Fever always accompanies to a greater or less degree, reaching as high as 104° to 105° F. (40° to 40.6° C.) in the severer forms, often followed by a decided chill.

In the *simple* form the tonsils are uniformly enlarged, injected, and bathed in thick, tenacious mucus.

In the *lacunar* form the tonsils are not always so uniformly enlarged, but one or both are markedly swollen, and dotted throughout the surface with yellow or whitish spots of various sizes; these spots are where the lacunæ or crypts are filled with débris from degenerated cells, caused by the bacterial invasion, and swollen from the occlusion of their outlets. These lacunæ or crypts discharge their contents in the latter stages of the disease, causing an offensive odor. The exudate from the crypts may extend in the severe types to the whole surface of the gland, rarely beyond, simulating diphtheria, a difference in the color being, however, apparent, the former being of a bluish or yellowish, creamy tinge, while the latter is more grayish.

In the *phlegmonous* form of tonsillitis, commonly known as quinsy, a more marked and general constitutional disturbance is noted, the tonsils are greatly swollen, and the pain becomes

intense and throbbing. There is here an invasion into the body of the gland, tending to form an abscess. One gland only, as a rule, is severely affected ; this enlarges rapidly, pushing toward the surface, in the line of least resistance, softening, fluctuating, and finally suppurating and bursting on the surface. The surrounding tissues soon become involved, and the glands of the neck are engorged, which no doubt gives rise to the term of peritonsillitis. The swallowing becomes almost impossible, fluids being regurgitated through the nose ; the breathing is difficult and the speech much restricted ; the fever runs as high as 105° F. (40.6° C.), being irregular in its intermittence, as in all forms of pus infections. The pulse may be as high as 130, and there is often marked salivation, earache, and even delirium. Headaches and backaches are common, and albuminuria is not rare.

Quinsy occurs more frequently when there are great climatic changes, usually during the cold and damp seasons. It rarely troubles very young children.

In children tonsillitis may be mistaken for the acute pharyngeal inflammation of scarlet fever, especially when in tonsillitis there is an accidental rash. Tonsillitis may, however, be distinguished from scarlet fever by a history of contagion, with an onset of vomiting, a strawberry tongue, the characteristic pulse, and, finally, the peculiar rash of scarlet fever. Diphtheria is claimed by some to be distinguished from follicular tonsillitis by the appearance of the false membrane, which extends to the surrounding parts, and is of a grayish, creamy tinge, curled at its edges, and, when removed, leaves a raw surface ; also there may be a history of contagion and a rapid weak pulse, with marked swelling of the submaxillary gland.

No one may trust such a differentiation, but, when possible, should always proceed to make a bacteriologic examination and isolate the patient until the report comes back from the laboratory.

Prognosis.—The prognosis of tonsillitis is generally favorable, even in the severer cases, and when the patient is in the gravest condition the abscess frequently ruptures spontaneously, giving immediate relief. It is only when ulceration takes place through the carotid or the abscess bursts during sleep, causing suffocation, that we hear of fatal results. The duration of the disease is from two days to two weeks.

Treatment.—The treatment consists of rest, quiet, and avoidance of exposure ; the best external application is ice or cold cloths applied at least every hour or two. For pain, dry heat or poultices often give relief. Free purging with calomel or salines

is of great value. In the simple form swabbing the throat with sulphate of zinc solution, twenty grains to one fluidounce, or tincture of red gum is of use. For older children gargling with extremely hot water for some ten or fifteen minutes, followed by gargles of astringents, such as potassium chlorate, two drams, or rhus glabra, one ounce, to a pint of hot water is very comforting and effective. The follicular form should be treated with similar gargles and astringents after thoroughly disinfecting the parts by a spray of a solution of hydrogen peroxid or a direct application of the same on a pledget of cotton into the crypts of the tonsils. Internally sodium salicylate, two to five grains thrice daily, may at times shorten the attack and relieve the pain. Calomel, $\frac{1}{30}$ of a grain directly on the tongue, repeated half hourly, is often useful. The phlegmonous form, in addition to the above, usually needs surgical interference. Whenever pus is suspected or fluctuation felt, a free incision is instantly demanded. This is best done on the soft palate outside the line of the anterior pillar, by means of a guarded bistoury, which should be wrapped within half an inch of the point. Should pus not be found, a probe can be passed deeper with safety. Great relief immediately follows the evacuation of the pus-cavity, and the inflammation rapidly subsides.

Sequelæ.—The sequelæ of tonsillitis have only recently been recognized to be of much gravity. In the last few years many investigators have made careful studies of this subject, and it is a well-established fact that the tonsils are an open gateway for the reception of many kinds of germs, and are as great a source of infection as the Peyer's patches or Brunner's glands.

Jessen, Buschke, Boeck, Buss, Hodenpyl, Ribbert, Du Mesnil, De Rochemont, Packard, Mayer, and Ohr have reported cases of grave conditions following attacks of tonsillitis. Thus it has been found that attacks of albuminuria, erythema, urticaria, purpura, erysipelas, orchitis, oophoritis, pleuropneumonia, strabismus, and paraplegia have been traced directly to tonsillar invasion. Angina pectoris, phlebitis, purulent pleurisy, and even tuberculosis have followed these attacks. Endocarditis is by no means an uncommon sequela, and general pyemia has been reported as consequent upon this apparently simple disease.

Otitis media, with its mastoid and intercranial complications, has frequently been traced to attacks of tonsillar inflammation; especially is this true following the throat troubles of scarlatina. Nor does the severity of the attack bear definite reference to the gravity of the sequelæ, which oftentimes appear late and after all the throat symptoms have cleared up.

CHRONIC TONSILLITIS (HYPERTROPHY OF THE TONSILS).

Chronic enlargement of the faucial tonsils may be found in infancy and early childhood, but it is much more frequent in later childhood. When present in early life, the cause is probably heredity. Later the enlargement may be due to previous attacks of acute inflammation or to bad hygienic surroundings, constitutional disease, etc. Bosworth describes two varieties of enlargement of the tonsils—the hypertrophic and the hyperplastic. In the former the glandular tissue is mainly increased, and the tonsil is rough and irregular in appearance. In the latter the fibrous tissue is increased, the tonsil presenting a smooth and round appearance. Very often tonsils exhibit a combination of these conditions. Tonsils in which the crypts are chronically diseased and have become the seat of cheesy deposits may be only slightly or not at all enlarged, but are a source of irritation and are subject to attacks of acute inflammation. Many symptoms are ascribed to hypertrophy of the tonsils, most of which are due to the obstruction to respiration, nasal and oral, caused by their presence. The chief symptoms are a snoring during sleep, restlessness, thick or nasal voice, liability to take cold, deafness, and tinnitus. Internal remedies have very little effect on tonsillar hypertrophy. Tonics, etc., should be given for the general condition, which is apt to suffer in these cases. As local applications, the compound tincture of iodin, diluted; tincture of the chlorid of iron (one part to three of glycerin); glycerite of tannin, and nitrate of silver (ten to twenty grains to the ounce) are used. Of these the iodin and the iron solutions are of the most value. They can be used in recent, soft hypertrophies. If the crypts are diseased, they should be cauterized with chromic acid, fused on a probe, or the galvanocautery point carried into the crypts. In moderate degrees of hypertrophy, also, the galvanopuncture may produce shrinking and atrophy. When the tonsil is large and firm, however, excision is the only treatment to be advised.

DISORDERS OF SPEECH.

Chiefly those Due to Anatomic Defects of the Speech Apparatus.

The importance of clear speech as a factor in mental and physical development is scarcely appreciated, and the subject fails to receive the attention it deserves. Defective speech is not always the result of defective mentality, as many seem to think, but it is

quite as often the cause. The child can not speak because it is thought to be stupid, whereas the child is often dull because it can not speak.

The speech faculty develops not by intuition, but by imitation, and there are two ways in which this development may be retarded: first, the child's imitative capacity may be weak, while all the other faculties are strong, and then speech, which is so largely dependent upon the imitative faculty, will necessarily develop slowly and imperfectly. Again, the child may have had poor models of speech in those having it in charge, and the result is equally unfortunate. This explains why these defects are so common among the poorer classes, where the imitative faculty is oftentimes but little developed and where the speech of the attendants is careless and slovenly.

Defective hearing is also an obstruction to the normal development of speech in children. Total deafness, either before or during the formative speech period, always results in faulty speech, because the child can not imitate what it does not accurately hear; but in addition to this often those "having ears, hear not." We have those who possess no ear for speech, just as there are those who have no "ear for music." They hear the speech as they hear the music, but the ear and brain do not make the fine distinctions so necessary for its sensitive differentiation or normal development; and so, just as the training of the ear forms an essential part in the training of the musician, and just as some ears require more training for music than others, so the training of the ear should not be overlooked in those children who are backward in the development of speech. They must be taught to hear the sounds correctly and to distinguish them, the one from the other, before they can ever learn to execute them.

Various other subjective physical conditions influence the development of speech in children. Indeed, anything which makes speech difficult or even disagreeable to the child may result in serious imperfections. Obstructions in the nostrils due to hypertrophied turbinals, irregularities of the septum, or adenoid vegetation in the vault of the pharynx act in several ways to impede speech development. They interfere with normal respiration and with the resonance of the voice; they set up a catarrhal condition of the vocal organs, and oftentimes press upon certain important nerve filaments, causing irregular choreic movements of the muscles controlling voice and speech.

In all cases of delayed or arrested speech development these parts should be carefully and thoroughly examined and put in

the best possible condition. Nasal spurs should be removed, deflected septa straightened, and hypertrophied turbinals reduced, always bearing in mind that the slightest deviation from the normal in the upper respiratory region during the formative period may render speech difficult and disagreeable, and therefore impossible, to the child who does not appreciate the importance of good speech sufficiently to make an effort to overcome even slight impediments.

We have known a small adenoid growth in the pharyngeal vault to cause stuttering of the severest type, and the defect of speech to cease immediately upon the removal of the growth. A long and curled epiglottis setting up a pharyngeal and laryngeal irritation may be the cause of the disordered speech, and we have had most excellent results, in at least one case, by the removal of its upper border.

Another fruitful source of defective speech is found in hypertrophied faucial tonsils which press upon the pillars of the palate and encroach upon the oropharyngeal resonant space. We often see, also, inflammatory adhesions binding the tonsils to the pillars, and preventing that free action of the palatopharyngeal and palatoglossal muscles which is so essential to good articulation. These adhesions should be destroyed, preferably by the electric cautery, if the child be sufficiently tractable, and the tonsil should be reduced in size, either by surgical or less drastic measures.

So important an organ is the tongue that its very name has come to be regarded as a synonym for speech, and "tongue-tie" is generally supposed to be the chief cause of defective speech.

By tongue-tie we mean a short frenum interfering with the movements of the tip of the tongue. This we do find, of course, in some children, and the snipping of this frenum undoubtedly gives greater freedom to the tip; but in many cases the trouble is not in the frenum alone, but in the disposition of the anterior fibers of the geniohyoglossus muscles. These fibers are too short, and they are inserted into the body of the tongue too far forward toward its tip, thus preventing some of the most important movements of this organ. And so in the majority of cases the snipping of the frenum is not enough to loosen the tongue, but an incision must be made through the mucous membrane low down in the floor of the mouth, and about one-half the width of the tongue, so that the anterior fibers of muscle are divided sufficiently far back to give the tongue its normal amount of free surface and motion. This operation is described and illustrated by G. Hudson Macuen in a recent number of the

journal, "International Clinics," and is one which is more frequently indicated than the somewhat simpler method of snipping the frenum. In cases of cleft palate the operation should be done in the first year, before the formative speech period begins, one of the chief indications in this operation being to retain as much as possible of the soft palate and uvula, and to restore to them their normal functional activity. Generally in these cases there is too little velum palati after the operation and too little activity in the muscles which control it, the result being an inability to close the palatopharyngeal chink (the opening from the oropharynx into the nasopharynx), and the stream of sounding breath which should pass out through the mouth during speech is allowed to escape through the nostrils; hence all the consonant sounds except the nasals must necessarily be defective.

Much may be done after the cleft palate operation to remedy this condition. All adhesions between the pillars should be broken up, and systematic massage of the palate, such as stretching with the finger, etc., should be practised.

The most important and the most neglected part of the treatment of speech defectives is undoubtedly the training. This can not begin too early. The child should have the best model as an example of speech, and the imitative faculty should be trained and developed. All "cute" baby talk should be discouraged, and only good forms of speech encouraged.

CROUP.

Synonyms.—Catarrhal Laryngitis; False or Spasmodic Croup.

Simple spasmodic croup is to be differentiated from catarrhal laryngitis.

Catarrhal croup, or acute catarrhal laryngitis, is an inflammatory affection of the larynx and trachea, noncontagious in nature, and excited by an acute catarrh. The most conspicuous feature is the "croup," or loud cry, or ringing metallic cough. It is usually followed by tracheitis or bronchitis. It may be primary, secondary to the infectious diseases, or traumatic. The lesions are found chiefly in the mucosa and lymphoid tissue of the subglottic region, and in severe cases they may be so serious as to produce laryngeal stenosis.

Croup is one of the commonest of the respiratory diseases of early childhood, occurring at any time, but usually in the changeable weather of autumn and spring. It may be mild or severe, and is of importance chiefly because of the uncertainty of the

diagnosis, as well as the distress that it occasions to the family and the anxiety felt by the physician, who, be he ever so skilful, not seldom fails to make a correct diagnosis on his first visit. We are called upon to distinguish, then, between this false croup and true or membranous croup, between false croup and laryngeal diphtheria, and between false croup and laryngismus stridulus. False croup is a common malady and so is diphtheria ; the others are comparatively rare. False croup occurs in isolated instances, although several members of a family may be so predisposed. It is never communicated and is noncontagious. Sporadic cases of diphtheria are not uncommon.

The **causes** are age, commonly between two and five years, neurotic heredity, enlarged tonsils, adenoid growth of the pharynx, exposure to cold, dampness, and disturbances of digestion.

Symptoms.—These diseases with the symptoms common to croup come on suddenly, with a more or less well-defined prodromal stage; perhaps none at all. The earlier symptoms, before the sudden attack, are usually a slight coryza, hoarseness, and cough, with redness of the fauces and feverishness or slight fever. True croup is a rare disease, and there is much doubt as to whether it is or is not simply a form of diphtheria. Jacobi does not speak of membranous croup at all, but classifies pseudomembranous croup and laryngitis together. There are points of difference clinically between these two diseases, but not enough to make us always certain. There is evidence to show—and this adduced by competent clinical observers, supported in their views by excellent pathologists—that instances of false membrane in the larynx may be anatomically the same, but not a true diphtheria (presenting the Klebs-Loeffler bacillus), or may be caused by some other agency. False croup comes on suddenly or may be preceded some hours or a day or two by catarrhal symptoms and slight fever. Sometimes the larynx and trachea are involved ; there is cough, but without stridor or spasm. The attack usually begins in the night, with almost no warning, except, perhaps, the cough, which changes and becomes short, deep-toned, and barking, with a peculiar resonant quality readily recognizable ; the inspirations have a whistling, crowing sound; the little one exhibits surprise or terror, sits up in bed, clutches at nearby objects, especially its mother, and seems to experience some relief in holding on to objects, the way asthmatics do, which enables the ribs to become more vertical, thus assisting in securing a deeper inspiration. There may be extreme recession of the thoracic spaces. The cough has a metallic, hard quality, associated with dyspnea, which lasts for perhaps

just a moment, or a little longer, when it lessens, and the child may, in half an hour or so, have entirely recovered and quieted down to sleep. The attack is not likely to be repeated more than once or twice at most; but several times during the night the short barking cough may recur. Next morning the child is apparently well, with the exception of the cough, which usually remains. The attack may return on several successive nights, but this is rare. Recurrences are more likely to be due to laryngismus stridulus or neuroses, and occur chiefly in rachitic children. The temperature may be little above normal, or about 101° or 102° F.; some observers report a much higher temperature.

Diagnosis.—In both false croup and true croup (membranous croup) the onset is sudden and generally accompanied by fright and dyspnea, but without delirium or convulsions. In diphtheria, of whatsoever form, there is no fright, and there are liable to be convulsions and profound debility. True croup generally begins with a chill, followed by fever, rising sometimes quite high—102° to 103° F. at the onset and up to 104° to 105° F. at the period of greatest intensity. False croup is often preceded or accompanied by symptoms of disordered digestion, and after the attack subsides the child is as well as ever, whereas in true croup and diphtheria there is marked depression during convalescence. In false croup the child declines to take nourishment, more because of the disturbed condition of the nervous system than of any pathologic local condition in the digestive organs, and cathartics are usually indicated and produce no overeffect or depression. In diphtheria cathartics are liable to induce considerable debility. The invasion of the larynx in diphtheria is not so abrupt, and usually takes place through extension from the fauces, and the stridulous breathing, both upon inspiration and expiration, is gradually established. The larynx may be primarily involved, making the diagnosis at first more difficult; yet it is, as a rule, not so sudden as in false croup. In false croup the stridor and dyspnea are more or less paroxysmal on inspiration, and are relieved by emetics and nauseants, usually disappearing on the second or third day. The hoarseness and aphonia gradually subside, more slowly than the dyspnea, and after, and perhaps by reason of, the action of emetics.

Death is very rare from false croup. Young children and those who are of neurotic ancestry are more frequently attacked, and although they may be enjoying at the time their ordinary health. In diphtheria disturbances in the voice remain and steadily increase, becoming oftentimes a persistent whisper. A

person of experience can make a decision from the breathing sounds, which should always lead to the use of antitoxin as a remedy. False croup usually attacks children beyond one year and up to five or six, and rarely after ten years. Diphtheria attacks much the same class of cases, although it may occur in younger and is frequent in older children. The collateral symptoms common in diphtheria must be watched for—albuminuria, lymphatic engorgement, and paralysis. A bacteriologic examination must be made in every case without delay, and should be repeated and is the only test to be relied on. Laryngismus stridulus is a neurosis without catarrhal symptoms which occurs in rachitic children, and which recurs in paroxysms at almost any hour. It may accompany tetany or convulsions.

Treatment of Spasmodic Croup.—The treatment of croup is simple but imperative. The child should be kept in one well-ventilated room, with an equable and distinctly moist temperature. The clothing should be sufficient, lest chill should occur. The bowels should be open in almost any event, calomel being the best remedy, although castor oil or salines may be used. The food had best be fluid, such as milk, guarded by alkaline water, or thin gruels or soups. For the milder varieties ipecac should be used to the point of nausea or full relaxation; it is well to combine this with soda, the powdered ipecac being preferable, although the syrup form is satisfactory. Ipecac may be given with calomel in minute doses every fifteen minutes in a powder on the tongue, and this it is well to combine with a little soda. For a baby of a year or two, $\frac{1}{60}$ of a grain of calomel, $\frac{1}{20}$ of a grain of ipecac, $\frac{1}{2}$ of a grain of soda, with a little sugar of milk, may be given dry upon the tongue every fifteen minutes. It is not wise to use severer depressants unless the fever runs high, when aconite, one-half to one drop every fifteen minutes, is of great utility, and is safe because of the ease with which its administration can be regulated. Antipyrin is useful in cases requiring nervous and arterial sedatives and when there is decided increase of mucous secretion. With the antipyrin it is well to give a few drops of brandy or some other alcoholic stimulant.

For a child two years old antipyrin, ½ to 1 grain, syrup of ipecac, 2 to 4 drops, sodium bicarbonate, 1 grain, brandy, 6 to 12 drops, may be given every half-hour to one hour during the severity of the attack or during the night, and at longer intervals during the following day. Pilocarpin is recommended but is dangerous, as it is too depressing to the heart; nevertheless it is sometimes of manifest value, especially in older children. Anti-

mony is not to be used, except possibly in vigorous older children, and then with caution. There are times when opiates are distinctly useful to allay excitement or distressing cough, but they are not to be repeated too frequently, one or perhaps two doses being sufficient to relieve a violent paroxysm. A piece of belladonna plaster the size of a small coin is placed by some on each side of the throat. To relax the spasm various mechanical devices are useful. A hot poultice applied to the chest is effective. A sponge wrung out of hot water will do as well. Counterirritation to the chest with oil and turpentine or camphorated oil is useful. Local cleansing or spraying of the nose or throat is to be recommended in some cases. If the rhinitis should be severe or obstructive, albolene, containing one grain of menthol and five grains of camphor to the ounce, is both soothing and stimulating to the nares. In the case of a nervous child the bromids may aid in securing a good night's sleep; an opiate, however, is rather better, and five to fifteen drops of syrup of Dover's powder acts nicely. Kerley recommends, also, to an infant three months old tartar emetic, $\frac{1}{100}$ of a grain; ipecac, $\frac{1}{30}$ of a grain; antipyrin, ¼ of a grain, every hour. In severe laryngeal spasm great relief is obtained by fumigations with calomel, vaporized on an ordinary milk warmer and alcohol lamp under a sheet tent. The Ermold lamp is better. Use ten grains in ten minutes, and let the child lie then for twenty minutes longer. This produces a copious watery secretion from the larynx.

So much importance has been claimed for the marvelous success of homeopathic treatment of croup that we asked Dr. J. Nicholas Mitchell, Professor of Obstetrics at the Hahnemann Medical College, to give us a full description of his methods, which he has most kindly done. We use his own words: "For hoarse, barking, dry cough, with fever, I use a mixture of tinct. aconit. napelli (leaves), ℥j; tinct. spongiæ, ℥ij; using this, according to the age of the child, from ½ to 2 drops every fifteen minutes till the cough loosens. When the cough is loose and the phlegm is interfering with respiration, with occasional spasmodic, barky cough, I mix one grain of the one-tenth trituration of hepar sulphur. in from four to six teaspoonfuls of water, and give one teaspoonful every fifteen to thirty minutes. Hepar sulph. calcareum is an impure calcium sulphid." We have tried this faithfully, and with fair result.

Membranous Croup.

Synonyms.—True Croup; Pseudomembranous Laryngitis; Laryngeal Diphtheria.

Membranous croup is essentially the laryngeal form of diphtheria, but is not proved to be always due to the Klebs-Loeffler bacillus. The reason probably is that the culture can not always be made from the infectious portion of the exudate. It deserves to be considered separately from the general heading of diphtheria because of its clinical features, which are those of a laryngitis. Diphtheria of the pharynx presents a somewhat different onset, features, and course. True croup appears suddenly, with a series of phenomena oftentimes endangering life by mechanical obstruction before the constitutional symptoms obtrude themselves at all. Absorption from the larynx is feebler and slower than from the pharynx; hence glandular enlargement and albuminuria are uncommon, nor is there the striking asthenia seen in cases of genuine toxemia from diphtheria. Postmortem, the structural degeneration in the viscera common in diphtheria is usually wanting. Contagion is feeble—because the discharges from the throat and nose are less or are absent—and the course is shorter. In short, the forms of diphtheria vary so widely that there may be instances where it can not be detected except by the secondary phenomena and complications.

Symptoms.—True croup differs little in its onset from false croup or catarrhal laryngitis, except that it is slower or not quite so abrupt nor so severe at first. There is the same high-pitched, ringing cough, hoarse voice, general discomfort, and quick but not weak pulse. The catarrhal phenomena are less marked or absent. Dyspnea increases slowly, and under excitement becomes profound, and alarms both parents and child. The temperature is seldom high—between 99° and 100° F., or a little over; the skin is pale and moist, and as obstruction progresses —steadily, as a rule, differing from false croup—the surface grows cyanotic. Breathing becomes much more difficult on the second and third days, and is accompanied by all the distressing features which follow this state—tossing, restlessness, irritability, etc. The child seizes on to objects to aid the respiratory action by muscular efforts.

The respiratory sounds become rough, without vesicular murmur. The symptoms, if unrelieved by treatment, progress from bad to worse, the temperature rises to 104° or 106° F., and death ensues by strangling, convulsions, or coma.

We reported a typical case in which the symptoms rapidly grew

FIG. 38.—IMPROVISED CROUP TENT, MADE FROM AN UMBRELLA AND A SHEET.

alarming, and intubation was performed by Dr. Freeman. The cough became so extreme that the junction of two ribs with the costal cartilages parted, producing hernia of the lung, which was cured by strapping. In this case the earlier bacteriologic examinations showed no Loeffler bacilli, but analysis of the material on the tube, when removed eight days after the operation of intubation, showed them to be abundant; yet at no time was there a large amount of membrane.

The **prognosis** of true croup depends on the age of the patient and the character of the epidemic. In untreated cases the mortality is very high.

Diagnosis is to be made by careful examination, which involves exploring the larynx by the finger to exclude retropharyngeal abscess and foreign bodies. The suddenness of the onset of true croup is not so great as in false croup nor in the above-mentioned states, yet it may arise most swiftly. Bronchopneumonia has a higher temperature, as a rule, and characteristic signs in the chest. The form of dyspnea is different too. The child is quieter; in spasmodic croup it is restless and struggles.

Treatment.—Nauseants should never be used, but antitoxin should be administered at once, in a full dose—2000 units or more. (See Diphtheria.)

Nowhere is the serum treatment so efficacious as in these cases. Inhalation of steam is a useful adjuvant; so, especially, are calomel fumigations. The tent should be applied at once and Ermold's lamp put in operation or the practical plan suggested by Holt. This is to take an ordinary chamber-pot, and place over the top of this a strip of tin; on this is placed the calomel (ten or fifteen grains), and beneath it an alcohol lamp, with the flame in contact with the metal. Soon the white vapor of mercury rises and fills the tent; and this should be kept up from ten to fifteen minutes. (Care must be exercised not to let this be knocked over by the child and cause a conflagration.) This may be repeated every hour or two, according to the needs of the case. It affords marked relief in most cases. After the calomel has been used the tent should be removed and the room aired. Sometimes vaporized mercury causes choking, if in too concentrated a form. Salivation is rare, but may occur among the attendants, who should be warned not to put their heads under the tent. Relief is seen usually after the second or third fumigation. It should be begun as soon as the croup is diagnosticated, before dyspnea becomes marked. The operation of tracheotomy and intubation to relieve the obstruction of false membrane in the larynx must not be delayed; certainly not until

cyanosis sets in, which may only occur just before death. Before the use of antitoxin the mortality was 30 to 40 per cent. from these operations. Now it is much less, and decreasing steadily, partly because of the enormous help afforded by antitoxin, which is peculiarly helpful to this class of cases, and partly because the operation of intubation is more promptly and skilfully performed. This usually suffices, but occasionally tracheotomy is made to supplement the intubation when that is insufficient to afford relief.

LARYNGISMUS STRIDULUS.

Laryngismus, laryngospasm, spasm of the glottis, or rachitic asthma is a disorder characterized by paroxysmal narrowings of the glottis, accompanied by spasmodic disturbances of respiration, occurring and recurring at intervals. It is a neurosis of the larynx, which is otherwise healthy. It should not be confounded with false croup (spasmodic laryngitis), infantile asthma, nor internal convulsions, and is rather a complication—at least, frequently—of other disorders. The paroxysm is produced by a spastic contraction of the muscles which narrow the glottis, occurs always during inspiration, and results from irritation of the recurrent laryngeal nerve or of the pneumogastric. It is asserted by some authorities to be a characteristic symptom of latent tetany. Laryngismus stridulus is a disorder of infantile life, usually from the fourth to the fourteenth month, and rarely beyond the third year. The children attacked present many marks of neurosis and irritability. The disease prevails in the cold months and among those too much confined indoors.

Causes.—The causes are constitutional and local. It is quite well established that the constitutional disorder known as rickets is at the bottom of most, if not all, of the cases of laryngospasm, and two-thirds of the children affected present well-marked evidences of rickets. In rachitic infants nervous irritability is generally exaggerated; in them slight exciting causes—emotional, exposure, and catarrhal—readily produce morbid respiratory conditions. Hereditary predisposition is blamed by some, but this is scarcely more than can be explained by the neurotic constitution and impaired nutrition. Local causes are numerous, but chiefly in the line of digestive disturbances, protracted or acute. Pressure from enlarged glands and diseases of the heart and liver are now and then exciting causes, as is also confinement in a vitiated atmosphere.

Symptoms.—The laryngospasm begins suddenly at night in a child otherwise apparently healthy, who then gasps for breath

and becomes rigid, throwing the head far back. The face becomes cyanotic, pale, or dusky; a cold sweat breaks out, and, after a brief interval, a few whistling or crowing inspirations are heard. The breathing again becomes "locked," and presently the child, straining to get its breath, reproduces the whistling sounds. This, repeated two or three times, is followed by expiration, a vigorous cry, and the breathing again becomes established. The glottis may be completely closed, and the muscles of the thorax and diaphragm tense; if the closure be incomplete, attempts to in-breathe are laborious and noisy, as described. The effect of the strain is shown upon the heart's action; if severe, consciousness may be lost, and the urine and feces voided involuntarily. The seizures vary in severity and in number; the milder ones may pass without much distress. The number of attacks varies from a few to thirty or forty in the twenty-four hours. If the spasm continues longer than a minute or two, death is likely to result. The paroxysms may occur as readily in the daytime as in the night. There is no accompanying fever unless some other disease supervenes. Dyspeptic symptoms are nearly always present. As the disorder progresses spasmodic phenomena occur, very often in other parts of the body, the most frequent of which is the indrawing of the thumbs and the upward turning of the great toe—"carpopedal spasm." The foot is sometimes drawn up against the shin, and the hands are sometimes bent upon the forearm. The course of laryngismus stridulus is irregular, the attacks occurring at intervals of varying length and severity; the course usually, however, "runs a circuit of aggravation, climax, and diminution." The duration is uncertain, and the first attack may prove fatal in a few hours, or it may last or recur for months. The complications of laryngospasm are very numerous, involving sometimes the membranes of the brain; oftentimes, also, there arise catarrhs of the lungs, bronchial tubes, larynx, and intestines.

Diagnosis.—Laryngospasm is rare in America, and so sudden and brief is the seizure and so free from disturbance the intervals that there should be little difficulty in recognizing the disorder. It is accompanied by no fever, change of voice, catarrhal symptoms, or cough; therefore there is no occasion to mistake it for croup or other organic disease of the larynx. It somewhat resembles false croup, but the clinical history is quite different.

Prognosis.—The prognosis varies, but is never good, a large proportion of cases ending fatally. This is not strange when one reflects upon the enfeebled conditions of those in whom it occurs.

Treatment.—The important element of treatment is constitu-

tional repair, and this is treated of at length under rickets and developmental methods. The digestion in most sufferers is conspicuously bad, and needs careful regulation. For the relief of the spasm a host of remedies are advised, the best of which are local or general counterirritants in the shape of cold or heat, baths, and volatile substances applied to the nose. In extreme apnea relief is afforded by placing the child in a hot bath and dashing cold water on its face and chest, or a hot mustard foot-bath with ice compresses to the head and neck. Strong currents of electricity, especially faradism, to the chest and larynx may stimulate breathing. If death be imminent, blowing into the lungs is sometimes effective, or intubation may be demanded. Tracheotomy is to be avoided. Artificial respiration is of use. The bowels should be promptly unloaded by an enema of water or glycerin; if time allows, a dose of castor oil or calomel should be given. Of depressomotor remedies, musk is said to be best; next come the bromids, valerian, and chloral hydrate, but opium should be used with great care. The dose of musk is from a grain to two grains in the syrup of lactucarium, or it may be given in the form of the tincture of musk—from five to twenty drops. During the interval tonics should be used, and it is well to bear in mind, as Jacobi points out, that in rachitis, while the heart may be of average size, the arteries are abnormally large, thus lowering blood pressure, and the circulation in the respiratory organs is slow and sluggish, tending to produce congestion and catarrh; therefore it is advisable to add cardiac tonics, as strophanthus, digitalis, or spartein sulphate. Many cases bear well $\frac{1}{6}$ of a grain of codein in a day. General convulsions are liable to follow the attack, and for this the cautious inhalation of chloroform or a rectal injection of from four to eight grains of chloral hydrate may afford relief. (See Convulsions, Treatment of, p. 509.)

COUGH.

The causes of cough are those conditions capable of producing pulmonic irritation, and the act of coughing usually begins in the respiratory mucous membranes. The utility of coughing is to expectorate the material which offends this surface, such as foreign bodies, mucus, or pus. Cough accompanies all forms of bronchitis, and such affections of the lungs as have a bronchitis associated with them. The cough of phthisis is due to a localized bronchial catarrh or to a laryngeal irritation. This irritation may arise in any portion of the respiratory tract. Cough is especially prominent in diseases of the pharynx and larynx. The

cough of laryngeal irritation is recognizable and characteristic. The presence of a foreign body in or about the respiratory passages does not necessarily or always produce a cough, as when the sensitiveness of the parts or the general blunting of the sensibilities reduces the physiologic irritability. This occurs in certain diseases of the brain and in the stupor induced by high temperatures, especially in the infectious diseases. When in a grave pneumonia or the late stages of tuberculosis of the lungs the cough subsides, it is ground for much anxiety. Cough may also be of centric origin. Irritation of the floor of the fourth ventricle above the center of respiration excites a cough. Foreign bodies in the meatus of the ear often excite a cough; so does disease of the ear. Infants during the first dentition sometimes cough as the teeth erupt. It is common for a decayed tooth to induce the same reflex disturbance. The cough which accompanies gastro-intestinal disturbances and which often is known to leave promptly when the condition is relieved is probably due to the secondary pharyngitis induced.

Cough may be dry or moist; constant or paroxysmal. The cough is dry when the cause of the irritation can not be readily or promptly removed.

A dry cough is heard in the first stages of bronchitis and in phthisis. Pleurisy at first induces a short, hacking, suppressed cough; later it is superficial and is always characteristic. The cough of ear trouble or dental irritation is not unlike it. The cough of emphysema is often dry for a period, and later only ceases after the dislodgement of a small mass of mucus. The nervous cough is also dry in character. Moist cough is accompanied by the output of mucous, mucopurulent, or bloody serum.

A constant cough implies persistence of the cause and is pulmonary. This is heard in pleurisy, phthisis, bronchitis, and pulmonary consolidations. A paroxysmal cough is one in which the irritation recurs, or the resistance is limited and may be of reflex or central causation. This recurring condition accompanies cavity formation in the lung, or where the pleura opens into the lung and lessens as the cavity becomes emptied and recurs as it becomes filled again.

If accompanied by vomiting or retching, it is a ground for suspicion of pertussis or phthisis. Pertussis is evidenced by paroxysms of coughing which are often followed by vomiting or retching, and the sufferers also exhibit a congested and anxious appearance of the face, with staring eyes, clutching at the side, etc., and followed by a long-drawn forceful inspiration or "whoop."

ACUTE BRONCHITIS.

Bronchitis is an inflammation of the bronchial mucous membrane of the large and small tubes, due to many causes, and is rather a symptom than a disease. Capillary bronchitis, or a catarrh of the smallest tubes, is no longer used as a division of the disorder, but is an integral part of bronchopneumonia. These final ramifications can scarcely be affected without also involving the alveoli. The only practical division is into mild and severe cases of bronchitis.

Causes.—Acute bronchitis is common in children as the result of cold and exposure. It occurs most frequently late in the autumn and early in the spring, when changeable weather is prevalent. Bronchitis also accompanies a large number of infectious diseases, especially in children, in whom the bronchial mucous membrane is peculiarly susceptible to congestion, as in typhoid fever, measles, whooping-cough, influenza, diphtheria, Rötheln, and scarlatina. In infants it is also a common accompaniment of dentition, and where there is a lowered condition of nutrition present, as in rachitis. Here it is more likely to be the feebleness of the individuals which renders them extremely susceptible. Irritating gases or substances introduced into the bronchi mechanically induce a bronchial catarrh; also any form of lung degeneration, notably tuberculosis. Bronchitis is also a common symptom of septicemia, and a special variety has been pointed out coexisting with putrid diarrhea. It is seen in diseases of the kidneys, where it may result from toxins or may evidence pulmonary edema. Frequently recurring bronchitis is very likely to have its origin in enlarged bronchial glands. No one bacillus can be claimed as the specific cause of this disorder.

Pathology.—The anatomic changes in acute bronchitis are practically the same, from whatever cause. Owing to the swelling of the mucous membrane, the lumina of the trachea and bronchi become smaller. There is temporary functional arrest of the action of the mucous glands, with subsequent increase in their activity.

As the congestion diminishes desquamation of the ciliated epithelium in the mucosa and swelling of the submucosa, with infiltration of the leukocytes, take place. The pathologic changes, as a rule, are confined to the mucous membrane, producing no change beneath it, unless the case is protracted, when there may be slight thickening of the walls. Should the smaller bronchi be affected, occlusion may result, with collapse of the alveoli supplied by them; hence supervenes a general collapse,

more particularly in infants, where the catarrhal products there heaped together produce unusual troubles—emphysema or alveolar catarrh. During the earlier stages, when the cough is spoken of as "tight," the epithelium after the primary congestion accumulates along with little moisture, and as these cells are not then reproduced, they do not readily come away in the sputum.

The sputum consists of cellular débris, of mucous plugs secreted from the glands in the bronchial walls, and of mucus which has been formed in the epithelial cells themselves, together with pus cocci.

Should there be intense congestion, the mucus may also become blood-streaked, and on examination of the submucosa ecchymotic spots will be found. The changes which sometimes take place in the character of the secretion have led to the subclassification into bronchorrhœa serosa, bronchitis fœtida, etc.

The lymphatic glands at the root of the tongue become enlarged, particularly in infants and young children—a point of great importance. These are liable to remain more or less engorged and to become the starting-point of subsequent attacks, and while not originally tuberculous, may readily become so. This is a large factor in the production of anemia, in delaying convalescence, and in provoking micturition.

In chronic bronchitis the acute form of the disease fails to undergo resolution; the cellular infiltration of the fibrous coat continues, producing a thickening of the whole bronchus with diminution of its caliber, leading first to hypertrophy and then to atrophy and impaired elasticity and favoring the formation of dilatations. If this process continues, the infiltration leads to the formation of fibrous tissue, resulting in interstitial pneumonia, and the contraction of this produces (especially when formed in the interlobular septa) a dilatation of the tubes, known as bronchiectasis. Chronic bronchitis is always accompanied by more or less atelectasis and emphysema.

Symptoms.—The first symptom of a mild bronchitis in very young children is usually a coryza, slight catarrh of the upper respiratory passages, some elevation of temperature,—100° to 101° F.,—and a hard, dry cough of more or less severity, lessened appetite, some evidence of discomfort, referred to the chest or stomach, slightly hurried respiration, and quickened pulse. The pulmonary resonance is normal; a few sibilant or sonorous rales may be heard near the middle, posteriorly, the state lasting from two to three days. When the mucus becomes more moist, and as recovery advances, there is a looser and less constant

cough, along with increased expectoration and greater liveliness.

Expectoration is not possible in infants, and is only an acquired capacity of later years—at six or seven; the mucus is therefore swallowed, producing more or less intestinal discomfort and tending to excite reflex cough.

If the temperature should run above 101° F., and especially if it remains high beyond the third or fourth day, a critical search should be made for evidences of bronchopneumonia. Before this can be determined we may have a group of symptoms which are common to severer bronchitis and to the pneumonic extension—a dilatation of the alæ nasi on inspiration, or other evidences of dyspnea, with a sinking-in of the tissues above the sternum or of the soft parts along the insertion of the diaphragm, and accompanied by increased rapidity of respiration and pulse. The temperature may become high or remain low. Temperature change in bronchitis is to be attributed to the cause rather than to the disease; there is no typical curve. If all this again mitigates in a day or two, apprehension lessens as to a deeper extension of the catarrh, even though there be pronounced nervous phenomena with grunting expiration and evidence of much pain on coughing. Anxiety is caused by a protraction of these symptoms; particularly if there be more or less temperature elevation, with an increased proportion of respiration over pulse-rate, a tendency for the infant or child to become apathetic, along with a cool, moist skin, we may anticipate finding evidences of bronchopneumonia upon exploration of the chest.

Prognosis.—The prognosis depends upon the cause which has produced the disease, and must be estimated in the light of the previous malady. The duration of a mild bronchitis is usually three or four days, and even when quite severe, rarely lasts more than a week or a week and a half. That which follows pertussis may last indefinitely; so in measles. The situation of the affection in the smaller or larger tubes is not of uniform significance in estimating duration. If the bronchial glands are enlarged, we may fear considerable protraction and ready recurrence of bronchitis, and a danger of tubercular infection. If the child is vigorous and appears well, the catarrh is easily thrown off and the disease ends promptly; if of lowered vitality, the disease lingers, from whatsoever antecedent cause. Constitutional defects, as rickets, are most unfavorable; so, indeed, is organic damage, such as cardiac valvular disease.

Bronchiectasis, or acute dilatation of the bronchi, may occur, due to inflammatory softening of the walls of the lesser tubes.

Aëro-emphysema is commonly associated with these dilated tubules. Hence will be found hyperresonant areas, with prolonged expiratory murmur.

Collapse of the lung may take place occasionally during the course of a bronchial catarrh. The symptoms of collapse are not always definite, but are usually a distressful cyanosis, excited struggles for breath, and possibly convulsions and marked asphyxia.

The physical signs are not so clear. Percussion sounds are rendered obscure by closely associated areas of emphysema (dilatations), with collapsed bronchi and pneumonic patches. Respiratory murmur over the collapsed area is weak.

Diagnosis.—The diagnosis of bronchitis is obvious enough ; a cough with bronchial secretion is not to be mistaken ; rales may or may not at first be heard, and may be few or many on one or both sides of the chest ; later, when these become moist and more numerous, they are more readily distinguished. The important points in diagnosis are to estimate the character and significance of the bronchial catarrh in the light of its antecedent factors and the vigor of the child. In a simple bronchitis, of howsoever great severity, there is no modification of the percussion-note, and in cases of circumscribed pneumonic consolidation there may be very little. The presence of bronchophony and bronchial breathing will aid us here.

Treatment.—The first thing in treating bronchitis is to regulate surrounding conditions or to enforce them more vigorously where the disorder complicates an already existing disease. A laxative is one of the first and most useful remedies, and the best is a dose of castor oil or a simple saline, such as magnesia. The old-fashioned combination of small doses of Dover's powder and calomel at frequent intervals gives prompt relief. Counterirritation to the chest is also most useful when applied thoroughly.

Next in importance to the salubrity of the environment may be ranked attention to the digestive organs. Food should be of the simplest, and taken slowly ; and milk and eggs rather than meat, with possibly aids to digestion and antifermentatives. Calomel is useful as a laxative, to deplete the liver and thus avert pulmonary congestion, to stimulate secretions of the various glands, and as a diuretic ; it is best given in small doses and frequently. Derivatives applied to the chest are of recognized value, and all means which aid dilatation of the cutaneous capillaries. Poultices of hot flaxseed or cornmeal, used posteriorly for half an hour at intervals of three or four hours for one or two days, removed carefully and followed by a stimulating application

both back and front, the whole chest being covered in with cotton-wool, is an efficacious treatment in our hands. One of the most important effects of this procedure is to tranquillize the child, who falls asleep soon after the first poultice and during the intervals. The constant use of the cotton jacket covered with oiled silk is preferred by some. The counterirritant may be turpentine, one dram to the ounce of sweet oil, or almond oil or camphorated oil or soap liniment. Oil of amber is excellent, or croton oil diluted. This should be rubbed in with the hand thoroughly, in a warm corner of the room, and followed by a special skin protection (as a layer of cotton-wool). It is sometimes well to accompany this with a hot foot-bath, which is always a wholesome febrifuge and derivative. As both an expectorant and a diaphoretic, hot drinks serve a useful turn when they can be administered, in which may be put a few drops of spirits (whisky) or sweet spirits of niter, or both. An emetic is exceedingly efficacious at the start, especially ipecac or hot water and salt (apomorphin is too depressing for children). A moistening of the air, as under a croup tent, is another valuable and prompt remedy often needed. Expectorants are useful solely for the purpose of stimulating bronchial secretion when scanty, and when the rales are few and dry and the cough frequent and harassing. Once secretion is thoroughly established, their function ends. The chlorid of ammonium is of some use in keeping up this action, especially if combined with a grain or two of potassium iodid, and may be continued with some advantage to control an accompanying intestinal catarrh. The coal-tar antipyretics are also useful expectorants, antipyrin coming first, then phenacetin and the others, and are best accompanied by some alcoholic preparation, as wine of pepsin, elixir calisaya, port or sherry wine; of course, in very small doses. It is wise not to try to check the cough by narcotics, as it is feared this procedure may precipitate pneumonia. For nervous symptoms opium used cautiously for a day may serve a good turn, especially Dover's powder. Alcohol is a useful remedy, tranquillizing and relaxing the cutaneous blood-vessels. When the glandular enlargements are considerable, creasote is recommended, and also, internally, preparations of iodin, especially the syrup of hydriodic acid. If the cough continues, an excellent way to expedite its going at the end of a week or two is to administer a full dose of castor oil, which alone may be sufficient; or if this fails, full doses of quinin for a day or two will often bring about the desired result. Many cases of bronchitis need no expectorant remedies, and do better under the use of belladonna or hyoscyamus and their derivatives. Our

custom is to employ a tonic from the start containing strychnin in pretty full dose, along with belladonna and the faithful use of vigorous counterirritation to the chest twice or thrice daily.

CHRONIC BRONCHITIS.

Chronic bronchitis or subacute bronchial catarrh is occasionally encountered when the child has either had repeated exposure and recurrent attacks of bronchitis or is so weakened in health as to be unable to acquire full restoration after a fresh attack. Sometimes it is not possible to account satisfactorily for the condition, though there will usually be a history of many rapidly following attacks of acute bronchitis or an unusual susceptibility. This last may be inherent or the result of specific disease, as pertussis, measles, or diphtheria. The rachitic child is peculiarly susceptible to bronchitis and irritative cough; also members of tubercular families or the so-called scrofulous children.

The **symptoms** are troublesome cough, expectoration, moist or dry rales, generally in both lungs (if fine rales, they are in the bases usually), absence of fever, and unimpaired resonance or, possibly, emphysema.

Diagnosis.—From fibroid phthisis the distinguishing points are absence of dullness and of such rales as point to dilatation of bronchi or consolidation, normal vocal fremitus and resonance, and one or more of the occasional outpourings of offensive smelling mucopus which accompany fibrophthisis.

Additional Suggestions as to Treatment of Bronchitis and its Complications.—Certain authorities recommend bicarbonate of soda, ten to fifty grains a day, with one grain of ipecac; ten to fifteen grains of ammonium chlorid a day, or two to five grains every three hours; apomorphin, in older children, $\frac{1}{100}$ of a grain every two or three hours, or potassium iodid to loosen a "tight cough"; terpin hydrate, in doses of ¼ to ½ grain, frequently repeated, especially in the chronic form; also terebene, ten- to twenty-drop doses. The complication of asthma is benefited by iodid of potassium, increasing doses to toxic effects, then slowly decrease and stop. Accumulated mucus may demand an emetic; if danger of suffocation or great effusion, frequent changes of position. If cyanosis arises and the voice is not heard, it is imperative to make the child cry—slapping with a wet cloth, swinging about, faradic current, etc. If cough is irritating, small doses of opium, codein, or extract hyoscyamus, the opiate especially, at night. Chlorid of ammonia evaporated on a hot stove, turpentine atomized, and compound syrup of white pine are useful

expectorants; compressed air and oxygen are of great help in dyspnea and during tardy convalescence.

Complications of Bronchitis.—*Pharyngeal catarrh* is a frequent cause of aggravated cough and demands local treatment, such as frequent washings with nitrate of silver (weak solution), alkaline antiseptic spray, extract of hamamelis, or applications of iodin, potassium iodid, and glycerin solutions, tannic acid in glycerin, or menthol camphorate in liquid petrolatum.

Fibrinous Bronchitis.—A false membrane may be formed, resembling diphtheria; use inhalations of steam, turpentine, benzoin, lime-water, chlorid of ammonia, fumigations of calomel, ten to fifteen grains every few hours under a tent. Internally give potassium iodid, large doses.

Asthma occurs along with or following bronchitis, and is frequently due to peribronchitis and emphysema; hence potassium iodid is indicated, with an opiate at night. Cleansing the nares is useful, and it is well always to remove all obstruction or hypertrophies. For the asthmatic attacks: tincture of lobelia, two or three drops; fluid extract quebracho or grindelia, ½ to one dram of each, will often relieve dyspnea (Jacobi). Fluid extract euphorbia pilulifera, increasing doses, is a very useful antispasmodic. Night cough and night irritation are relieved by bedtime doses of bicarbonate of soda or carbonate of magnesia and codein and hyoscyamus or laxatives of castor oil or cascara.

Emphysema in children presents an easier diagnosis than in adults: the lung tissues are more elastic; cellular activity of the alveoli is more active and more easily influenced by nutrition and by remedies, respiratory exercises, and blood repair; to induce sneezing is of value. Nebulized expectorants and resinous preparations are useful.

BRONCHIAL ASTHMA.

Bronchial or spasmodic asthma is a form of paroxysmal dyspnea along with wheezing respiration occurring in sharp attacks; but perfect health is enjoyed between the intervals. It occurs quite frequently in childhood, and rather oftener in the upper than in the lower walks of life. Most writers agree that it is a neurosis resulting from disturbed innervation of the pneumogastric or its ramifications or the vasomotor nerves, and causing a spasm of the muscles of the air-passages. Hay-fever is an affection which closely resembles bronchial asthma and alternates with it. The affection seems to run in certain families, especially those of irritable and unstable nervous equilibrium, and exciting

causes are only operative when there is a predisposition to the disease. Oftentimes no definite exciting cause can be demonstrated. The respiratory center in the medulla is thought by some to be irritated by vitiated blood of a wide variety of sepsis. Enlarged bronchial glands pressing upon the pneumogastric nerve or upon the bronchioles accounts for many cases. Bronchitis alone or in an emphysematous lung is frequently recognized as an exciting cause. Various mechanical irritants to the upper respiratory mucous membrane, as the air of certain localities, dust of various sorts, palpable or impalpable powders, odors, as of flowers or of hay, the effluvia of animals or decomposing substances, and an endless variety of causes of most differing kinds are competent to excite an attack. Changes in the barometric pressure and disturbances of the stomach are the most efficient instrumental causes. Asthma and eczema sometimes coexist or alternate with each other.

The **pathology** of bronchial asthma is not known; there are many theories, such as that it may be due to spasm of the bronchial muscles; also that the attack is due to the swelling of the bronchial mucous membrane, to a catarrh of the bronchioles, etc. Talma says that the phenomenon is a spasm of the larynx and aditus, rarely a spasm of the constrictors of the glottis, and that it is partly under voluntary control, which should be cultivated as much as possible.

Symptoms.—Asthmatic attacks usually occur without warning. In some there are slight premonitions, rather vague; in others there is itching of the skin, copious urination, or a slight nasal catarrh. The paroxysm generally comes on at night, the patient being awakened by distressing dyspnea, steadily increasing, with characteristic wheezing and oppression or pain of the chest. He must sit up, and is more comfortable holding on to objects, with shoulders elevated and head thrown back, to give the muscles of respiration and their allies the utmost play. The face becomes anxious, pallid, and, later, cyanotic; the skin is moist, and respiration is loud and wheezing. The respirations are rarely much increased in number; speech is difficult; the ribs expand but little; inspiration is jerky and expiration prolonged and laborious, and there is little or no thoracic expansion. The pulse is rapid and thready, there is no elevation of temperature, but in a prolonged attack it becomes subnormal, the extremities growing cold and clammy, the face livid. After the paroxysm there is usually much exhaustion, and the patient sleeps. On awakening there is little left except muscular soreness, and the return to usual health is prompt. Percussion dur-

ing the paroxysm shows hyperresonance, and there is heard some diminution or prolongation of the vesicular murmur. Toward the close of the attack moist rales are distinguished, and piping, wheezing, and cooing sounds.

The **prognosis** in young subjects is good; especially is improvement marked in some cases about the time of puberty, and if there be no serious complication or grave underlying disorder.

The **diagnosis** should not be difficult, but bronchial asthma may be confused with obstruction of the upper air-passages, foreign bodies, croup, edema of the glottis, suffocative urticaria, new growths in the larynx, tracheal stenosis, pulmonary edema, pleuritic effusion, uremia, and cardiac disease. Bearing in mind the absence of elevation of temperature will enable one to distinguish asthma from the inflammatory affections. Emphysema and asthma frequently coexist, and the one may superinduce the other. Cardiac asthma is rare in children.

Treatment.—Most sufferers from bronchial asthma are below par in health in some direction, and these factors need special reparative treatment as well as specific medication. Some sufferers from asthma, however, are of magnificent physique, as evidenced by two personal friends of the authors, who have made themselves famous on two continents as monumental specimens of vigor. The treatment divides itself into the special medication directed to the prevention of the paroxysm and the use of remedies to relieve the suffocative attacks. It may as well be frankly stated that there has been very scanty success in the treatment of this disorder. This may be because physicians, as a rule, do not give it sufficient attention, and the most conspicuous instances of relief are occasionally seen at the hands of certain quacks or of physicians who keep secret the means and manner of their work. It is quite impossible to enumerate here the wearisome array of remedies and measures offered for the relief of asthma, especially if we include, also, disturbances from that disease, known as hay-fever, rose cold, and the like. Wherever there can be discovered exciting causes, the most obvious of which are nasopharyngeal obstructions, these must be removed, and thoroughly; hypertrophied turbinated bodies, or lingual or pharyngeal tonsils, adenoid growths, nasal polypi, and catarrh of any part of the respiratory tract demand attention. Climatic and domestic conditions must be revised; diet should be modified and, as a rule, lessened. Hygiene; out-of-door life; cold sponging, always preceded by a dry rub; change of climate here and there, in the choice of which there is almost no special rule; the use of certain tonics (cod-liver oil and iron are lauded) and of various altera-

tives; long courses of arsenic and of various sorts of alkalies (because uricacidemia is so often the chief fault)—produce a fair proportion of cures. The best single remedy is potassium iodid, and perhaps the most satisfactory plan of treatment, certainly in our experience, is the following: Put the sufferer to bed, or limit his activities as much as possible; feed upon an absolute diet of skimmed milk, with peptonizing and antifermentative measures if necessary; keep the bowels open, preferably with salines (mixed ones are better than single, like Apenta water), and administer potassium iodid in rising doses, one drop of a saturated solution extra each day, until full toxic symptoms are produced; then slowly reduce in the same order to the point of tolerance, and keep at that for about a month; then slowly lessen until none is taken. In so complicated a malady as bronchial asthma, with its peculiar features, the vigorous health so often seen, which is suddenly and overwhelmingly paralyzed by intensity of distress, argues either for a profound neurosis or for diathetic conditions as yet not understood, but for which it is reasonable to hope and expect to discover a controlling remedy sooner or later. The relief of the paroxysm is also not to be predicted; some simple thing may accomplish this perfectly or powerful medicines may be demanded. Morphin, administered under the skin, especially along with a little atropin, promptly relieves most adult cases, and may be given, with the utmost caution, to children; but its use is, of course, not to be encouraged. The inhalation of chloroform offers prompt and temporary relief. Chloral hydrate, given by the mouth or rectum, is better and more lasting. Nitrite of amyl or iodid of ethyl inhaled, or nitroglycerin given by the mouth, pilocarpin under the skin, the use of many pungent smokes, as of stramonium, relieve some cases. Perhaps the best-known remedy is the fumes of niter paper; and safe enough it is, especially if administered under a tent. There are various combinations put up in the form of cigarettes, the materials of which are modestly concealed; or powdery substances to be burned, sold in the shops as infallible remedies, are quite useful. Tobacco is advocated, but is depressing to children. The nitrites are praised, but are disappointing; so are grindelia and quebracho. The best, perhaps, is the fluid extract of euphorbia pillulifera in increasing doses. Talma claims that patients should be systematically taught respiratory gymnastics, learning to breathe slowly and deeply. We can also assert that this treatment has done much for those under our control.

PULMONARY EMPHYSEMA.

Pulmonary emphysema is a condition of the lung in which air to an abnormal extent accumulates within it. The interstitial form, known also as the extravesicular, gives rise to no untoward symptoms, as a rule. The vesicular variety, also known as alveolar emphysema, is of much more importance if the process be extensive, but is extremely rare in children under ten years of age. This is again divided into two varieties: (1) Compensatory emphysema, wherein the vesicles of one portion of the lung are abnormally distended in consequence of the disablement or insufficient expansion of some other part of that organ. This form of emphysema is occasionally seen in young children, the causes being predisposition, enfeeblement, lowered nutrition, and locally mechanical obstruction, which produces increased vesicular pressure. Excessive coughing in pertussis produces violent respiratory efforts, inducing air-bubbles to escape into the interlobular tissue, as well as hyperdistention of the alveoli. In most cases, however, complicating acute bronchitis and pertussis the emphysema is but temporary, and small structural change is left. (2) Substantive emphysema is a chronic and scarcely curable malady, characterized by abnormal distention of the air vesicles along with structural changes in their walls. It is almost never seen in children under ten years of age, but is more frequently encountered during adolescence. It would seem to be due in part to hereditary tendency. Bronchial catarrh inducing swollen mucous membranes, and much pressure in the bronchioles due to sticky mucus, induce topical collapse, and the neighboring lobules endeavor to do double work and become hyperdistended.

Again, during enforced respiratory efforts with a closed glottis, as in violent paroxysmal coughing, the air is driven back and becomes lodged in the less resisting areas, as the apices and anterior borders of the lungs. In any event there needs to be some inherent feebleness or degenerative change to account for the anatomic alteration. This may be a chronic inflammation, a pneumonitis attended with the production of fibrinous tissue, along with an atrophy of the normal parenchyma. The post-mortem changes are much the same as in the emphysema of adults. There is usually some hypertrophy of the right ventricle of the heart and perhaps secondary dilatation. The symptoms of emphysema in young children are oftentimes negative, and when present, are like, but milder than, those in adults. Dyspnea is one of the most common symptoms, at first only

noticed upon exertion, and later more severe upon slight catarrhal disturbances of either the nose or the nasopharynx, the bronchi, or digestive organs. Cough is readily excited, especially in winter, and asthma often arises. Children rarely exhibit the barrel-shaped chest of emphysema, but they do sometimes show an increased depth anteroposteriorly and rigidity. Percussion gives few signs of value; the thoracic walls of children being so elastic and the organs small, transmission of resonance is favored from other parts. Auscultation reveals a low-pitched respiratory murmur with prolonged expiration; the second sound of the heart may be accentuated. Recovery may be looked for if the disturbance has not continued too long. Emphysema itself does not imperil life except as a complicating factor in other diseases.

Treatment.—The treatment is mainly prophylactic; exciting causes should be guarded against and receive prolonged treatment. Attention to the skin by cool bathings and thorough rubbing must be faithfully and continuously given, and woolen underwear worn. The digestive organs must be guarded from disturbance with unusual faithfulness. Many tonics are of value, of which iron has a suitable place, especially in the form of Basham's mixture. Nux vomica is of some efficacy, and arsenic more so. In the chronic bronchitis which so frequently coexists iodid of potassium is of special value. Next come the resinous preparations, then terebene and guaiacol. Cod-liver oil is a reliable tonic.

ACUTE BRONCHOPNEUMONIA.

Bronchopneumonia—also called catarrhal pneumonia, lobular pneumonia, capillary bronchitis—is an inflammatory disease of the terminal bronchioles and pulmonary air vesicles, affecting the lobules in scattered areas. The disorder is in the main a catarrhal inflammation of the bronchioles and air-sacs, although the peribronchial and interventricular tissues are also involved. The disease often proves fatal in a few days, or it may linger in a chronic form, leading to secondary changes or inducing a tendency to tuberculous infection.

Causes.—The primary cause is usually bronchitis, either the simple catarrhal form or that which accompanies or follows infectious processes, especially measles, whooping cough, diphtheria, or tuberculosis. Bronchopneumonia is in nearly all cases a secondary disease; it may arise as a primary disease, or from an untraceable cause, or as the result of irritants, mechanical or gaseous, entering through the mouth, nose, or respiratory pas-

sages. In the bronchopneumonia of diphtheria the streptococcus is the usual cause. In the new-born it may result from inhalations of the maternal secretions during birth. In many cases the specific cause is the pneumococcus, the tubercle bacillus, or in certain instances the staphylococcus aureus and albus or streptococcus pyogenes. Secondary cases are usually due to a mixed infection. Most fatal cases occur under two years of age, especially during primary dentition. Pneumonias stand next to diarrheas as a cause of infantile mortality, and the lobular is much more common than the lobar form. Infants show a marked tendency to catarrhal processes. Depraved vitality is a powerful predisposing cause, the result of unwholesome environment and diet and improper care. Especially is this noticeable during the prevalence of epidemics of measles, diphtheria, and whooping-cough, during convalescence from which sufficient care is too rarely exercised. Season has much to do with the prevalence of this disease, it being by far the more frequent during the winter and spring, and especially if the weather be changeable from wet to dry. Steady cold is rather favorable to immunity from catarrhal pneumonia, but during damp summers it is liable to prevail.

Pathology.—The essential lesion in bronchopneumonia is an inflammation of the walls of the terminal bronchi, bronchioles, and the adjacent alveoli, with the rapid casting off of epithelial cells, one after another, along with a few leukocytes or red corpuscles accumulating within. As the process continues there is an increase in cellular desquamation, with outpouring of mucus, filling up the tubes and air vesicles; thus centers of consolidation are formed in different parts of the lung, at times only attacking small portions, and again invading large areas irregularly. Both lungs are usually attacked, sometimes so extensively as to involve a whole lobe. Bronchopneumonia develops by the regular invasion of successive portions of the lung, and resolution takes place in the same gradual manner. The mottled appearance seen on inspecting an infected lung is due to areas of red and gray hepatization in close proximity. Absorption takes place more readily of the fibrinous exudate than of the cellular elements: and hence in bronchopneumonia, where the inflammatory products are mostly cellular, they are more slowly resolved than in lobar pneumonia, in which they are mostly fibrinous. The process begins in the terminal bronchi and extends into the bronchioles and air-sacs, either by inflammation, following the epithelial lining, or mechanically, by violent inspiratory efforts induced by coughing. Thus the smaller tubes become

plugged up, producing atelectasis, even where the act of expiration forces the air out of the cell, and inspiration being a weaker act, they fail to become or are only slowly refilled. Once the vesicles become collapsed congestion takes place, which is also partly mechanical, inflammation results, and the temperature goes up. Parts of the lungs which are not hepatized are congested and edematous, and the air-spaces in the alveoli are encroached upon by the congested blood-vessels and epithelium.

On microscopic examination the bronchioles will be found filled with an exudate containing leukocytes and epithelial cells; occasionally, also, blood-corpuscles. The alveoli in the immediate neighborhood of the affected bronchus will be more completely filled with the exudate than the outlying ones. The capillaries in the walls of the bronchi are somewhat distended, and the general appearances of an interstitial inflammation are present.

These areas of collapse are mostly symmetric, occurring in the posterior borders of both lower lobes, and sometimes in the upper ones, and may arise during the acute stage or when the pneumonic process is more definitely established. There are no clearly marked stages in bronchopneumonia as in lobar pneumonia, and all of them may appear in different areas of the same lung. Nearby these zones of congestion the bronchi frequently become dilated, owing to the weakened condition of the bronchial walls; yet this condition is liable to disappear entirely upon recovery. Emphysema frequently arises in the course of bronchopneumonia, usually vesicular, and more commonly in the upper lobes, but also may be wide-spread, and is more common after whooping-cough. There may be interstitial emphysema also, caused by the rupture of air vesicles lifting the pleura or extending between the lobules. Bronchopneumonia may persist, the proliferative cells taking part in the formation of new connective tissue, causing persistent thickening. This occurs especially after other than first attacks. The walls of the bronchi and the peribronchitic tissue are at times subject to a persistent thickening and fibrinous formation, producing a chronic bronchopneumonia. The cicatricial tissue surrounding the bronchi causes an increased dilatation in the walls already weakened, and there follows saccular as well as fusiform dilatation.

The macroscopic appearances usually show a tendency to lobular limitation, these lobules being raised somewhat from the surface and exhibiting alternations of dark-red or grayish color. Sometimes a whole lobe may be affected, and then it is very like the appearance of croupous pneumonia. Next to the consolidated lobules there is sometimes seen emphysema, the one overlying the

other. On the lung being cut, the various lesions are seen most beautifully, areas of atelectasis and of peribronchitic congestion adjoining the smaller bronchi (from some of which issues mucus or mucopus) and emphysematous patches. The air vesicles are themselves sometimes inflamed and found filled with red blood-cells. In the very acute cases extravasation of blood occurs into the alveoli just beneath the pleura. Adjoining the consolidated areas there is usually pleurisy, especially over considerable areas of consolidation, binding the lung to the chest-walls. There is also occasionally a moderate amount of exudation into the pleural cavity.

The causes of death in pneumonia of children are (1) exhaustion, (2) acute toxemias, and (3) complications. Exhaustion is the most common and is to be met by sedulous attention to hygiene and diet. Nursing infants should be spared overofficious attention. The complications are most liable to cause death, except the pleurisies.

Symptoms.—Bronchopneumonia, as has been said, is almost always a secondary disease, and it is liable to arise in the course of a bronchitis or of some one of the contagious diseases—measles, scarlatina, whooping-cough, influenza, and diphtheria especially. There is then to be recognized some increment of fever in the rate of pulse, and especially a difficulty in breathing. The fever is at its height in from three to five days, and usually quite irregular in course, above 102° up to 104° or 105° F., or in rare cases even higher. The height of this becomes a fair index to the virulence of the disease. Deaths with low temperature occur only in very feeble children. The rise and fall on the temperature-chart is gradual, and feverishness persists for a considerable time. The pulse becomes greatly increased (125 to 150), and the ratio between pulse and respiration is from one to two, or even less. The cough is usually short and hacking, less distressful than in a severe bronchitis, and more consciously controlled. It is more pronounced, constant, and distressing in lobar pneumonia. The cough is a valuable index of the vigor of the child and the progress of the case. When this becomes feeble, it is a sign of respiratory and other organic failure. The pain felt is less in front, as in bronchitis, and more in the side. The alæ of the nose are seen to dilate, especially in little children. When atelectasis takes place, the dyspnea becomes more marked and the expiration "grunting"; the skin becomes livid and dusky, and, as we have often had occasion to remark, the characteristic symptom here is increased relaxation and leakiness of the skin. As the symptoms become severe the

child remains more and more quiet, holding its head well back and supporting itself by the hands; it is a characteristic feature that the worse the malady, the more submissive is the child. Expectoration is liable to be mucopurulent, but infants and children under six or seven years swallow and conceal this. Appetite is generally lost, but thirst is excessive. The suckling of infants is difficult and incomplete, on account of the dyspnea. Strength is rapidly lost, and somnolence is a very evil sign. Vomiting may occur at the outset, and diarrhea is a bad complication. Irregular fever with high pulse-rate indicates a protracted course, and possibly chronicity. The heart must be carefully watched; a feeble first sound is of gloomy import, though death is more likely to result from respiratory than cardiac failure. In the beginning there are the usual signs of bronchitis—first dry and later moist rales, without dullness. As areas of congestion arise dullness on percussion may be recognized; but it is difficult to elicit unless pronounced, and then only on using the lightest percussion. These congested areas are best recognized by moving a stethoscope here and there while the child cries, and locating by increased vocal fremitus and resonance. If a lobe of the lung be extensively affected, the signs are more pronounced, but ordinarily it will be necessary to explore the two sides symmetrically and estimate by these lesser sounds. Moreover, the symptoms vary from day to day, almost from hour to hour. Characteristic symptoms are oftentimes best heard high up in the axilla. When atelectasis or emphysema is present, there is a great variety of changes in the symptoms, which may occur swiftly. There are practically no characteristic signs in bronchopneumonia, but if in addition to the rales of bronchitis there is heard subcrepitation, with harsh or blowing breathing and impaired resonance in the lower part of the lungs posteriorly, and along with these pronounced and increasing prostration, we may regard the disease as clearly evidenced.

Complications and Sequelæ.—Pulmonary collapse is less a complication than a feature to be expected. Sometimes it is so extreme as to warrant the use of the old term "suffocative catarrh." Pleurisy is a frequent but only rarely a troublesome complication. The most serious sequela is tuberculosis. Bronchopneumonia renders a person peculiarly susceptible to this poison. Meningeal symptoms sometimes arise toward the end of the disorder, probably due to hyperemia of the meninges or to toxemia. Chronic or continued pneumonic process is a serious feature not uncommon. Cases may go on to rapid or slow resolution and yet recovery be complete and thorough. A form of continued

catarrh of the alveolæ is described by Douglas Powell, usually seen in the apices of the lungs. This begins as a proliferation of the alveolar epithelium. In the milder cases the inflammatory products are expectorated, leaving the alveolar walls undamaged; when the inflammatory process is greater, the proliferated epithelium and the leukocytes are sufficient to block the alveoli completely. The exudate undergoes degeneration, and may be partially absorbed and partly expectorated, but the alveolar walls have been damaged and collapse results from their agglutination. The inspissated products may remain a long time, or the fibrous stroma may become involved and a hyperplasia result, and ultimately a fibrosis takes place of the affected area. Such cases may linger long in the condition or fall into serious states, or die of exhaustion or some intercurrent malady, especially tuberculosis. Other forms of bronchopneumonia suffer relapses or recurrences and result in a chronic interstitial pneumonia.

Associated lesions of the lung are enlarged bronchial glands, more or less emphysema in almost all cases, gangrene rarely, and abscess more frequently than is suspected.

Diagnosis.—It is important to examine every case of bronchitis critically for the intercurrence of a possible pneumonia, also in the infectious diseases. This may be recognized by sudden increase of fever, acceleration of pulse and respiration, fine subcrepitant rales, blowing breathing, and small areas of percussion dullness. Catarrhal pneumonia may exist without signs of consolidation. If the disease is first seen in a well-developed state, it may readily be confused with croupous pneumonia, but scattered areas of dullness in the opposite lung will help to distinguish it, along with the history of the case and its gradual onset. Plastic pleurisy usually accompanies bronchopneumonia and confuses the physical signs. When gastro-intestinal disorders or nervous symptoms are marked features, the pneumonia may escape attention unless searched for. Here the changed respiration and pulse-rate should be an indication.

The **prognosis** is always bad, the average mortality being nearly 50 per cent. under five years of age, and less over that period. In private practice (Holt) the mortality is from 10 to 30 per cent. The cases which follow whooping-cough are most serious; also those complicated by previous marked debility. Duration is usually from two to three weeks; mild cases may terminate in a week. The symptoms to be considered in making a prognosis are the height and course of the temperature, the occurrence or absence of neurotic phenomena, the state of the digestive organs, the presence of cyanosis, and the extent and

character of the diseased areas, and also whether or not the process follows an infectious disease.

Treatment.—The chief element of treatment is prevention, bronchopneumonia being essentially a secondary disease and controllable in most instances by proper care. The measures used should be early applied. Any case of bronchitis may be complicated by more or less pneumonia. (For treatment see separate article on Treatment of Pneumonia.)

CHRONIC BRONCHOPNEUMONIA.

Chronic bronchopneumonia, also called fibroid phthisis, is a condition of the connective-tissue framework of the lungs following upon other diseases. The condition is known also as chronic or interstitial pneumonia, cirrhosis, or fibroid induration of the lungs, and is usually accompanied by dilatation of the bronchi. It is generally of one side, protracted in its course, and is characterized by a change from the normal pulmonary tissue to the excessive formation of connective tissue, and is often associated with or followed by tuberculosis. It is held by some that fibroid phthisis begins as a tuberculosis in all instances. It is certainly proved that many inflammations of serous membranes aforetime ascribed to exposure to cold are really tubercular. This is especially true of the pleura. The affection is rare in children, they usually exhibiting a more active process during an inflammation, with a larger power of complete repair. When seen in adults, the origin may frequently be traced to childhood. A simple bronchitis may set up changes which result in an overgrowth of the interstitial connective tissue. (See Chronic Bronchitis.) It is exceedingly uncommon in children to find an abundant connective-tissue growth the result of an ulcerating tubercular process in the lung, although it is possible. The usual origin of fibroid phthisis in children is in the results of pneumonia and bronchopneumonia, especially the latter. Bronchiectasis, a cylindric dilatation of the bronchi, is also frequently present, due to excessive coughing. An entire lobe may be affected, but usually only a portion of a lobe or areas in the lung or the walls of the bronchi may be thickened.

Pathology.—The changes in the lung are usually upon one side and in the lower lobes. The parenchyma of the lung appears destroyed and replaced by connective tissue. There is usually peribronchitic thickening and also bronchial dilatation, producing cavities of varying sizes. Cavities may also be formed through ulcerative change, particularly where secretions are re-

tained and become decomposed. Tubercle bacilli, active or latent, may be found in the tissues or secretions or locked up in the connective tissue. The lung usually suffers some diminution in size, which is shown upon inspection. The pleura is generally affected, and adhesions are liable to be particularly dense. The sound lung exhibits compensatory hypertrophy and often emphysema. The heart rarely escapes displacement, and the cavities suffer change because of the increased resistance in the pulmonary circulation. A common result of pleural inflammation is adhesive pericarditis; this may be found here, as well as a general venous stasis.

Symptoms.—There are always in chronic bronchopneumonia cough and expectoration, though the latter varies considerably in amount at different periods. When cavities exist, the sputum may separate into three layers of froth, serum, and pus; it is often of a most offensive odor. If tubercle bacilli be found, they may betoken a recent infection from outside or a manifestation of latency. Elastic fibers will be shown if ulceration is present. Hemoptysis occurs, usually of moderate amount; but if a fair-sized vessel be affected, danger results, or possibly death. Even in favorable cases dyspnea arises upon exertion, or even, in worse ones, while the patient is at rest. Fever and its effects are absent or occur only intermittently. Should it arise, it is a symptom of some secondary complication. Nutrition suffers little, and the general health is fair. That infallible sign of chronicity, clubbing of the fingers and toes, is more constantly seen in interstitial pneumonia than in any other condition, except, perhaps, congenital heart affections. The physical signs are similar to those of chronic tuberculosis. Certain signs are, however, distinctive of this malady. The respiratory murmur is much impaired unless there is bronchiectasis, when the breathing is distinctly bronchial. The two sides of the chest show a notable difference in shape, mobility, and size, especially when pleural changes are extensive. Retraction is more common if the apex is affected. Exploration of the chest may reveal areas of consolidation, retained secretion, or vomicæ; and in this malady more often at the base than at the apex. According to the shrinkage or change in the shape of the chest, or where in the pleura or pericardium adhesions have taken place, there are seen changes from the normal in the cardiac impulse. Other changes the outcome of altered relationships between the lungs and the heart may be manifest, but are sometimes very obscure. If the compensatory hypertrophy of the right ventricle suffers, we have evidences of venous stasis, pulsation of the jugulars, edema, enlarged liver, cyanosis, and the

like. The course of fibroid phthisis is essentially chronic, and, on the whole, progressive, although there may be periods of fair health, and yet death may occur from intercurrent disease.

The **diagnosis** should not be difficult if a history can be obtained. Chronic tuberculosis is excluded on account of excellent general nutrition, the absence of fever, and the mode of onset. In fibroid phthisis there is a history of chronic cough and expectoration, with repeated blood-spittings, physical signs of lung destruction (generally of one side and often with the formation of cavities), or signs of shrinkage and hardening. The heart exhibits hypertrophy soon or late, with dilated right ventricle. The disorder may be confounded with chronic pleurisy, in which there is also much contraction of the side. In cancer of the lung or pleura the thoracic physical signs are similar, but the course and duration are quite different.

Prognosis.—A sufferer from fibroid phthisis may live a great many years, especially if the individual is in comfortable circumstances and can or will be reasonably careful. The danger is from intercurrent diseases.

Treatment.—Nothing can be done to repair the damage to the parenchyma of the lung; much, however, can be done to place the patient in good health and keep him there. In the accomplishment of this a judiciously regulated outdoor life, attention to the diet, and, above all, to the skin, will do much to lengthen the sufferer's days. Respiratory gymnastics are capable of doing a good deal in improving the condition of the lung, especially suitable exercises in a wholesome atmosphere. High altitudes are theoretically contraindicated, because of the deficient respiratory capacity. This must be determined in each particular case, estimating the collateral conditions, whether a dry or a moist climate be the best. Expectorants are to be avoided as a routine measure, but must be prompt and efficient when needed. Potassium iodid is useful in certain stages of bronchitis, and creasote or guaiacol will at times serve a useful end. Cod-liver oil is the stand-by always, and other nutrient tonics—malt, hypophosphites, etc.—are frequently of use.

CROUPOUS PNEUMONIA.

Croupous pneumonia, or lobar pneumonia, is a specific inflammatory disease of the lungs due to infection by the bacillus lanceolatus (pneumococcus) accompanied by exudation into the vesicular structure, with subsequent consolidation. Clinically, it is an acute, self-limited disease, manifested by high fever, dyspnea,

cough, and rusty sputum, running a definite course of from four to nine days and ending by crisis.

Causes.—Lobar pneumonia may occur at any age, but is not nearly so common in infancy as bronchopneumonia, being rare before the age of two years, and in children is most common between five and ten. Unlike bronchopneumonia, which seizes upon debilitated children, lobar pneumonia affects those who are robust and in vigorous health. Croupous pneumonia may follow or arise as a complication of measles, whooping-cough, influenza, typhoid fever, and tuberculosis, but in children under three years of age this is most unusual. Exposure to cold is the predisposing cause and depressing conditions are contributory, but the exciting cause is the bacillus lanceolatus (diplococcus pneumoniæ) of Fraenkel. This microbe holds also close relations with cerebrospinal fever, middle-ear disease, and endocarditis. Among other bacteria causing pneumonia may be mentioned the bacillus pneumoniæ (Friedländer) as well as the streptococcus and staphylococcus pyogenes. No doubt other bacteria are sometimes responsible for croupous inflammations, such as the bacillus typhi abdominalis. There is some reason to believe that this form of pneumonia is contagious.

Pathology.—The lesions of lobar pneumonia occurring in children are much the same as those of the adult, being an acute exudative inflammation extending throughout the whole of one lobe or the major part of one lung or limited portions of both lungs. The stages are those of congestion, red hepatization, gray hepatization, and resolution, progressively, just as in the adult.

During the first stage, or the stage of engorgement, the lung tissue is congested. It is of a deep-red color, firmer to the touch than normally. On section a frothy liquid exudes, made up of serum and blood. The lung still crepitates, and a cut portion will float. The alveoli contain fibrin, leukocytes, and detached epithelium. The capillaries of the air vesicles are dilated and tortuous, and the alveolar epithelium is swollen. The first stage lasts a few hours or several days. When the output of inflammatory products has reached its height, these, collected within the alveoli and terminal bronchi, increase the size of the lung as well as its density ; hence the stage of red hepatization. The lung is of dark-red color, solid, airless, and firm. It is easily friable, cuts like liver, and sinks in water. This stage occurs earlier in children than in adults.

Microscopically studied, the alveoli are observed to be filled by threads of coagulated fibrin, in the meshes of which are

seen red blood-corpuscles, polynuclear leukocytes, and alveolar epithelium. The alveolar walls are infiltrated, and leukocytes are seen in the interlobular tissue. Thereupon follows a period in which the exudate becomes changed in color from red to a mottled gray; this is called *gray hepatization*, and is a process of degeneration and softening. The air-cells are filled with leukocytes. The fibrinous network and the red blood-corpuscles have disappeared from the alveoli. Finally comes its last stage; in this the exudate is softened. Disintegration and degeneration of the cell elements continue until they are rendered soft and capable of absorption. The lymphatics take up and remove these products, and this is called *resolution*. During the course of an ordinary lobar pneumonia no histologic change takes place in the lung structure itself; consequently recovery occurs by resorption and expectoration of the exudate.

In children lobar pneumonia is frequently bilateral; the lobe most frequently affected is the lower one of the left lung, and pneumonia of the apex is quite prevalent among children, though rare in adults. A bronchitis may accompany the process in a fair proportion of cases. A plastic form of pleurisy occurs where the consolidation reaches the pleura; more rarely an effusion takes place and empyema may result. Pleurisy of a mild sort is frequently present yet unrecognized; it is less often a complication in lobar pneumonia than in bronchopneumonia.

Symptoms.—Lobar pneumonia, being a primary process, manifests itself abruptly, with few or no prodromes. The seriousness of the malady is promptly defined by the onset of convulsions or vomiting, or both, usually a certain amount of rigor or chilliness, with a pronounced rise of temperature. The clearly marked chill, so common in adults, is rarely seen; instead of this the nervous system often loses its balance (convulsions) or a mild delirium often appears, or the stomach rejects its contents. The temperature rises rapidly, and inside of a day may reach 104° or 105° F., continuing with slight daily remissions and declining by rapid crisis from the seventh to the tenth day. It often then falls below the normal. The pulse is full and bounding, increasing in rapidity as the temperature rises, but respiration is accelerated in even greater proportion than either, so that the pulse-respiration ratio of one breath to two pulse-beats is pathognomonic in this disease. Pain is usually present, referred vaguely to the chest or abdomen; dyspnea may become a most urgent symptom. A short, dry cough may appear early, which sometimes seems to give rise to pain. The cough, however, may not come on until later, and changes its character as the disease progresses. There

is rarely any expectoration before the sixth or eighth year, and then it may exhibit the rusty character common in adults. The face is often flushed, or circumscribed spots of redness appear on the cheek; the eyes are bright and the facial expression is anxious; the alæ of the nose are dilated, showing increased inspiratory effort. In the milder cases there are restlessness and irritability; in severer ones there is apathy, at times complete. Appetite is usually lost, and sometimes marked digestive disturbances persist throughout the disease. In certain severe cases the nervous symptoms are prominent throughout, usually in proportion to the height of the fever, and death may occur in a convulsion before even the characteristic physical signs appear. If the nervous phenomena appear at first only, they are of little gravity; if they arise later, they are of gloomy portent. In intensely severe cases the dyspnea and cyanosis develop markedly, the respiration is shallower, the pulse more rapid and weak, the child becomes stuporous, and death occurs quietly or with motor excitements.

The physical signs in lobar pneumonia in children are not so clear as in adults, and yet when present, are of much the same character. There is percussion dullness over the consolidated portion of the lung, with increased resonance elsewhere. Dullness on percussion is sometimes masked by areas of emphysematous lung overlying the consolidated portion, requiring deep percussion to bring out the flatness. The expansion of the affected lung is seen to be lessened. Crepitant rales are heard in about one-third of the cases, and are best recognized during the long, indrawn breath after coughing. The breathing is distinctly bronchial where consolidation has occurred, and vocal resonance and fremitus are increased—not very trustworthy signs. In the beginning of the disorder fine rales may be heard here and there, more rarely in children than in adults; during resolution moist rales are heard extensively. There is great variation in physical signs and all symptoms; in some cases the cough is absent until many days elapse; the cough and physical signs sometimes remain for several days after the temperature has dropped. The presence of pleuritic exudate produces a dullness, with only a muffling of the breath-sounds. There are, moreover, certain varieties of lobar pneumonia which have received special names and vary considerably in their symptomatology, in some cases strongly simulating meningitis with hyperpyrexia, convulsions, delirium, or coma, and yet without cough or the physical signs of pneumonia. These cases are liable to arise among debilitated children, and the pneumonia is often of the apex. Abdominal

pneumonia is a name given to those cases marked by digestive disturbance, vomiting, diarrhea, and abdominal pain. These may be so severe as to simulate peritonitis. The pneumonia in these cases is only to be discovered by careful search. Wandering pneumonia is very like bronchial pneumonia in certain of its symptoms, but not so entirely similar as to fail of a differentiation.

The commonest complication of croupous pneumonia is pleurisy, but it is usually not very severe and may entirely escape detection. The effusion may be plastic or occasionally purulent, especially when following measles and scarlet and typhoid fevers. Pericarditis may complicate the pleurisy or occur alone. The meningeal form, or, better termed, the cerebral form, is very alarming, but rarely does this indicate a true meningitis. Disturbance of the kidneys occasionally arises; abscess and gangrene are rare sequels.

Diagnosis.—When seen in the fully developed form, a lobar pneumonia is difficult to differentiate from a bronchial pneumonia. Wandering pneumonia with areas of fleeting consolidation is even more confusing. The abdominal type of pneumonia is readily overlooked, and here the respiration and pulse-rate must be carefully measured. The suddenness of lobar pneumonia and its high fever, vomiting, and convulsions before the physical signs are manifest, together produce a marked similarity to the onset of scarlatina. Pleurisy with effusion is to be recognized by its movable character, absence of breath-sounds, rales, and by changes of vocal resonance and onset with pain.

In the diagnosis between the cerebral form of pneumonia and meningitis it is important to bear in mind that in the former we have rapid pulse and hurried respiration. In meningitis there is usually a slower pulse, with slow, irregular breathing. In lobar pneumonia usually a number of its own characteristic features will appear to distinguish it from the marked irregularities, slow, insidious onset, irregular temperature, pulse and respiration rates of bronchial pneumonia. The unilateral character of lobar pneumonia will mark its distinction from the bilateral manifestations usual in bronchial pneumonia.

Prognosis.—Bronchial pneumonia in children is a far graver disease than primary croupous pneumonia. In the secondary form of croupous pneumonia, however, it is more serious, yet in the septic cases the mortality is high. Of evil omen, too, are pronounced cerebral symptoms, hyperpyrexia, and great dyspnea, but experience proves that even the severest cases recover surprisingly. The mortality is about 5 to 10 per cent.—it is large under three years but very small from that age to ten years.

THE TREATMENT OF PNEUMONIA.

It has seemed to us better to include under the treatment of pneumonia the consideration of both forms common in children,—bronchopneumonia and lobar or croupous pneumonia,—with references, also, to pleuropneumonia and other complications, as there are a number of points common to the treatment of all forms of bronchial and pneumonic inflammations.

When one is confronted with a well-developed case of inflammation of the lungs in a child, it is far from easy, sometimes practically impossible, to differentiate clearly between various forms. In the treatment of such it is imperative to put the sufferer to bed at absolute rest and to control the environment, making sure of a uniform degree of warmth, which should be from 70° to 74° F., with abundant air,—not less than 1000 to 1200 cubic feet for each child,—and to be prompt with means for readily changing the air as it becomes in the least degree vitiated. An open fireplace with fire burning is one of the most nearly perfect devices, in addition to whatsoever other arrangements may already exist for ventilation. Even in a hospital-ward air modification is frequently possible as above suggested, and always to be welcomed. It is a distinct advantage to modify the air of the room, where this is feasible, by some volatile, preferably resinous, principles which are stimulating to the respiratory mucous membrane, especially when dyspnea is a marked symptom. Here it is well to surround the child for a time with a tent made of sheets, such as is used for croup, and in this place a kettle, on which, in boiling water, may be vaporized beechwood creasote, pine-needle oil, turpentine, compound tincture of benzoin, or eucalyptus. There should be as little disturbance as possible in the way of noise, moving objects, and the like, especially when cerebral symptoms supervene. The sufferer should be handled as little as possible; frequent examinations are entirely needless, tending to exhaust strength and patience. During the day an abundance of light may be admitted, sunlight being especially welcome. So soon as night falls there should be no illumination excepting such subdued light as is necessary for the guidance of the nurse.

Bathing is of the utmost use, not only for the purpose of keeping the skin in a wholesome continued action, thus relieving the strain on the overburdened lungs, but it is also a remedial agent, and enjoys a very important place in the category of remedies, especially during the stage of collapse in pneumonia, usual in the bronchial form. A bath at 102° to 105° F., into which the

child may be plunged for a moment, materially assists a failing heart or embarrassed respiration and rouses waning powers. During the course of a moderate fever a bath at 103° to 104° F. and sponging with water at 70° to 80° F., or, if the child is strong, iced water applied is most useful. If the temperature is very high, the water may be cooled while the patient is in the bath, for the purpose of reducing the fever to a reasonable degree, or towels wrung out of iced water wrapped about the trunk for from ten to thirty minutes while sitting in the hot bath. The fever *per se* may be let alone; it is generally the nervous symptoms which require treatment, and upon these judicious bathing exercises an excellent control. The use of a hot foot-bath, to which may or may not be added a small quantity of mustard, will prove an excellent measure in relieving delirium, restlessness, or insomnia. Some recommend the addition of alcohol to a warm sponge-bath, and then fanning the skin until it becomes cooler. Some immerse the patient in water at 90° F. for fifteen minutes, followed by constant rubbing, keeping the feet carefully warm the while. There are those who recommend, even in children, the cold pack or ice poultice, and this has proved of the utmost value to us. Cold produces contraction of the cutaneous capillaries, followed by active dilatation, relieving the heart, increasing excretory action and the elimination of toxins, and thus reduces the fever and the cause of fever (S. Baruch). The application of cold produces neurovascular stimulation, transmitted to the heart, increasing ventricular force. Baruch's method of bathing in fever is to place the child in a bath at 95° F. and bathe the face with water at 75° + F. Ice is then added to the bath until 85° F. is reached. During the whole of this period of five minutes friction is maintained over the entire surface. This may be repeated in from four to six hours if the temperature remains above 101° F. The minimum temperature of the bath should be 80° F. If during the interval the temperature remains high, compresses at 70° F. may be employed. The cold pack, if used continuously, should always be done with great care. The cloths are wrung out of water at 65° F. or 70° F. and laid around the patient, who is then enveloped in blankets. Hot bottles should be kept at the feet, especially if any shivering or chilliness occurs. If it continues, stop at once. The ice poultice is made by incorporating finely crushed ice in a cold poultice of flaxseed or Indian meal. As has been said, pyrexia is of itself not a matter for alarm, and hyperpyrexia rather indicates profound blood-poisoning, which needs other and more radical remedies than cooling

measures. The child should not be allowed to remain long lying on the back for fear of hypostasis.

Clothing.—The clothing of the child should be of wool, as thin as possible, but entirely protective in quality and extent. The bedclothing should be of the lightest, and yet sufficiently warm. Thin woolen sheets are best, but a blanket worn next above, with a sheet underneath, does very well, and in milder cases muslin sheets above and below may be used, but linen never. The body clothing should be so adjusted as to be readily taken on and off, especially that over the shoulders and chest, by being open down the front and back, so that counterirritants may be readily applied, poultices or stupes or fixed dressings, according to the requirements of the various states.

Food.—Inasmuch as the strength of the patient is sorely taxed in all forms of lung disease, the utmost care needs to be exercised that he shall maintain every atom of strength by means of food in such quality and amount as shall require no strain on the processes of digestion and yet supply abundant force. For infants, in whom bronchopneumonia is one of the commonest and often fatal forms, instruction as to feeding has been given elsewhere. Food should be of the simplest nature for such little ones, whether well or ill, and during the height of the febrile process and well into the stage of convalescence had best be guarded by digestants. For somewhat older children, accustomed to taking solid food, an ordinary fever diet is admissible. This should consist largely of milk, which may also be predigested or guarded by digestants, supplemented by, or alternated with, stimulating broths of various sorts, and later semisolid food, as soft-boiled eggs and meat purées. Only when the fever is well past may a variety be introduced or increased. The very great tendency in some forms of pneumonia to be accompanied by, and some believe caused by, putrefactive agents in the intestines makes it important to be on guard against evidences of gastro-intestinal disease and to meet them promptly. The bowels must be quickly relieved of any disturbing matter by laxatives or simple enemata, or both, or some antifermentative medicines may be employed to control this tendency.

Stimulants.—While it may not be wise to employ alcohol and other stimulants as routine practice, nevertheless in our judgment it is well to err on the side of prudence and administer alcohol as soon as there is a clear indication for its use, for, aside from apparently sustaining properties, it many times simulates a food. The most valuable property of alcohol is to act as a tranquillizing agent. This it does particularly well in children and in

disorders of their lungs. The form of alcohol used may be a definite amount of whisky or brandy, or some believe that in disturbances of organs of respiration Jamaica rum is peculiarly valuable. For very little infants the milder form of wine-whey serves an admirable purpose, and is certainly less irritating to a disturbed stomach than the stronger preparations. Some accept more readily the heavier wines, as sherry and port; but champagne, so valuable in adults, is not especially acceptable to children. Aromatic spirit of ammonia is stimulating; caffein or its preparations, it may be tea or coffee as ordinarily made (or, at least, well made), is of admirable temporary use in failing heart action, sometimes far better than alcohol, indeed, or even strychnin or digitalis. It has a happy effect in certain forms of delirium, alone or along with alcohol, a bromid, codein, or sulphonal. The ammonium salts are useful as cardiac stimulants as well as for their expectorant properties.

Counterirritants.—There is considerable variation in the opinions of the most eminent physicians as to the usefulness of counterirritants for hyperemia or consolidated areas of the lung. Our own belief is that they serve a very excellent purpose if judiciously employed. Any constant application to the chest, if of considerable extent, is liable to the objection that the skin becomes macerated when moist applications are continued for many hours or days, and this maceration can not but be objectionable in many ways. It inhibits to a great extent elimination from the skin, which needs to be encouraged in every way, weakens the capillary vessels, while at the same time it relieves their tension and renders the skin susceptible to the effects of exposure. The occasional use of poultices has the advantage of acting as an excellent febrifuge as well as relieving the cutaneous capillaries, at the same time determining the blood to the surface and away from hyperemic areas. They are of distinct efficacy when there is high fever accompanied by hot dry skin, painful dyspnea, with a dry cough or tightness of the chest, or scanty expectoration. Our method of using poultices (as an occasional practice) where there seems an indication for them is this: Poultices should be made moderately thick and quite hot,—about 105° F., or even 110° F. when the patient has become accustomed to their use,—about the thickness of a hand, and of a size to cover the posterior surface of the lungs on both sides completely. They should also be covered front and rear with thin cloth, as cheese-cloth, and so adjusted that the child may lie upon this poultice and not be oppressed by any weight upon the chest. This is allowed to remain in contact from a half-hour

to an hour. It is then cautiously and quickly removed. Then immediately rub in with the hand, while warm, some counterirritant, as turpentine, one dram, to sweet oil, one ounce, or camphor oil or amber oil. This is applied over the surfaces where the poultices lay, and also over the entire chest. Then immediately envelop the chest in cotton-wool, well warmed and dry. The child may now be allowed to remain quiet for three hours, and if necessary, this is to be repeated—the poultice on the back, thorough inunction of a counterirritant both back and front, and a fresh layer of cotton to surround the chest. It may be necessary to use this every three, four, or five hours, for the first day, and possibly once or twice applied on the second day. Beyond this it is rarely necessary to make use of local heat and moisture, though occasionally it may be carried on to the third or fourth day. The cotton should not be covered with silk, which inhibits cutaneous exhalation too much; it ought to be changed when it becomes in the least befouled, and, better, after each poultice afresh. It sometimes happens that no poultices are needed; then a turpentine stupe, for a quarter to a half-hour, once applied, or possibly twice, is sufficient. These certainly relieve pain when present, and also have an excellent effect upon the bronchitis.

The use of any of these applications may excite the child and do more harm than good. If so, mere hot foot-baths will serve, followed by the silk-and-cotton jacket.

Some authorities use flaxseed poultices, hot, to which one part mustard is added to five or six of flaxseed meal, and applied until the skin is well reddened; then this slipped off and hot, dry flannel placed over the part. For pleuropneumonia or a concomitant pleurisy this form of counterirritation is excellent. Other authorities use a cotton jacket, with or without oiled silk, throughout the attack. To us this seems a rather unattractive measure, but is highly recommended, and is far less troublesome than the systematic poulticing. It may be well to follow active poulticing with the oiled-silk jacket, which is certainly effective and convenient.

Medicines.—The use of medicine should be purely symptomatic. It is not well to direct too much attention to the checking of a cough, unless this excites or exhausts the patient; the cough is relieved in a very great majority of cases by attentions of a local kind—by the use of sprays, application of astringents to the pharynx, upper air-passages, and oleaginous sprays or vapors containing resinous principles. Opium has not so great an effect in depressing respiration as is often feared, but must be used carefully. It is of great value in relieving the character of

the cough; used sparingly and in certain combinations it produces a happy effect upon respiration and delirium. Opium has an objectionable effect upon the intestines, especially where these are distributed, unless diarrhea should supervene, which is comparatively rare. From ½ of a grain to three grains of Tulley's powder is recommended. Dover's powder in the form of an elixir enjoys the confidence of others. Paregoric has its admirers, and the elixir of opium is one of the best preparations. Two or three well-directed doses are better than continued administration. Syrups of all kinds are to be avoided as menstrua; a little glycerin with aromatic water, or elixir of pepsin, or simple elixir is better.

Cold is the best antipyretic, but it must be borne in mind that during extremely hot weather a longer application must be made than in cold. If the extremities are chilly, avoid cold baths. During this condition a hot bath is better and more efficient in reducing temperature, because with cool extremities the interior of the body may be hot, and hot baths bring the blood to the surface, thus changing its site and relieving congestion. During the use of cold baths it is wise to apply warmth to the feet in the way of hot bottles. A good form of cold pack is to apply it from the waist down, leaving the arms free, and keeping the feet warm the while. A small baby may be wrapped in a single wet towel and covered with a blanket. This may be repeated every five or ten minutes. If the child is extremely weak, the pack may be left on and cold water poured over it from time to time. Extreme watchfulness must be maintained that the temperature does not drop to subnormal, whereupon artificial heat must be again applied. Feeble babies are better for a warm or hot bath, with tepid pack, using water with or without alcohol; or a warm bath gradually cooled, the little bodies being rubbed the while. The heart may suffer seriously toward the end of pneumonia, and is always depressed, needing stimulation soon or late. Heart failure is better prevented than cured. Alcohol is not the best cardiac stimulant for children, and the disturbed condition of the kidneys generally present renders it unwise to use too freely. Digitalis stimulates both the heart and arteries, increasing peripheral resistance. It is well given in a few good doses and then omitted or lessened. When an effect is desired only upon the heart, spartein or strophanthus is best.

The coal-tar antipyretics have a certain value, to be used occasionally, not so much for the relief of pyrexia as for their expectorant qualities. Phenacetin does this not quite so well as antipyrin (phenazone), but each of them assists in the relief of nerve

disturbances. Aconite is not altogether free from danger, but relieves the circulation admirably. Liquor ammonii acetatis, especially in the form of mistura ferri acidi, has a happy effect in depleted subjects, in those for whom iron is indicated, or in whom there is insufficient urinary elimination or disordered kidneys. For the stimulation of the heart digitalis, strophanthus, and spartein each have their place. Also strychnin is to be regarded as a valuable ally. Strychnin, with its happy effect upon the respiratory activities, is frequently given, especially when there is a clear indication for its need as an invigorator of nervous force, and it usually should be used in full doses, from $\frac{1}{30}$ to $\frac{1}{60}$ of a grain, three or four times a day. One of the most reliable remedies is nitroglycerin, which dilates the capillaries and thereby aids circulation immensely. Potassium iodid also has this effect, likewise acting as an eliminant. The ammonium salts have their place and their advocates. Carbonate of ammonia is a good heart stimulant, producing a very brief effect, but liable to disturb the stomach. Toxemia calls for thorough stimulation, not too long continued, or lessened as the needs decrease. Alcohol is here indicated in sufficiently large amounts, and in acute cardiac failure even hypodermically. A rapid heart-beat is always suspicious and calls for full stimulation at once. Chlorid of ammonia is useful toward the end of pneumonia and aids the cellular activities. Aromatic spirits of ammonia is quite as good, and more acceptable for its effect upon the heart. Quinin in the beginning of convalescence seems to exert a peculiarly beneficial effect upon the cough, and sustains the action of the nervous system.

Pulmonary edema requires emptying the lungs by dry cups or an occasional emetic, as apomorphin, $\frac{1}{200}$ of a grain subcutaneously, and stimulation of the heart and excretory organs. A sharp purgative will assist in this. For cyanosis, in addition to the cardiac tonics and vasodilators the direct or indirect application of oxygen is of the highest value to save or prolong life.

Edema from renal diseases is efficiently relieved by pilocarpin, $\frac{1}{40}$ to $\frac{1}{20}$ of a grain subcutaneously. Hemorrhage occasionally occurs from the lung, but is liable to be due to cardiac complication and is manifested in the trachea or bronchi.

Gangrene of the lung occasionally complicates pneumonia resulting from the infectious diseases, suppurative processes, or foreign bodies. Here stimulating inhalations are indicated, especially of the resinoids,—tar, turpentine, terebene,—on hot water or nebulized.

Hernia of the lung sometimes occurs, pouting out at each respiratory action. Should deformities of the chest-walls oc-

cur, respiratory gymnastics help more than anything else, and should be continued for months or years. The bronchial and mediastinal glands frequently become congested and inflamed in divers diseases of the thorax, though frequently are the result of protracted bronchial and nasal catarrh, or metastasis from other glandular disturbances, especially in rachitic or tubercular cases. The principal symptoms are those of pressure upon the tracheal veins, or nervous attacks of coughing with crowing inspirations, changed voice sounds, bronchial respiration, dullness over the sternum (upper part), and dullness about the interscapular region. The control of this complication is difficult, and consists of absorbents applied externally, mercurial ointment, or potassium iodid and iodin. Internally, arsenic increasingly and other aids to nutrition should be used.

PLEURISY.

Pleurisy or pleuritis in infancy and childhood is almost always a secondary disease. Sometimes there is inflammation of the pleura without any appreciable exudate. Such cases are called dry or fibrinous pleurisies. More often the disorder is accompanied by an exudation of fluid—serous, serofibrinous, or purulent—into the pleural cavity. When the exudate is visibly purulent, the disease is called empyema or purulent or suppurative pleurisy. Serous effusions are less frequent in children than in adults; very rare under three years. Empyema is much more common in the young than in older folk.

Causes.—The greatest number of cases occur from birth to the fifth year; the next greatest during the following five years up to the age of ten. It appears rather more frequently in boys than in girls, and more often on the left than upon the right side. Pleurisy is generally unilateral. There is usually some recognizable antecedent disease, but this is sometimes not clearly evidenced; it is most commonly a disorder of the lungs, especially pneumonitis. It is possible to find only exposure to cold and dampness the exciting cause, and many believe this to be sufficient. It is probable, however, that such factors act rather as predisposing causes, reducing the constitutional resistance, thereby preparing a soil for the invasion of pathogenic microbes. Injuries to the chest-walls are also credited with being a sufficient cause. It must also be borne in mind that in children there are fleeting forms of pneumonia lasting but a few days, which may precede or coexist with effusions of the pleura. Recent bacteriologic researches on the pleural exudate have demonstrated un-

mistakably the presence of the staphylococcus and streptococcus (Koplik), and shown this disorder to be similar to the affection in the adult.

In some effusions, however, no microbic elements are exhibited. At present we are in a position to assume the diplococcus as the connecting link between the process in the lung and the pleuritic inflammation. The exposure to devitalizing agencies, here as elsewhere, lessens the resistance of the constitution to the host of micro-organisms which constantly lurk in the upper air-passages. Our difficulties in accounting for the means and avenues through which these reach so remote and protected a part as the pleural cavity are frequently almost insuperable. The infectious diseases, various forms of tonsillitis, the exanthemata, typhus and typhoid fever, pertussis, influenza, suppuration, and abscess of mediastinal glands may precede and directly cause an attack of pleurisy. Suppuration elsewhere, with or without a recognizable pyemia, also septic wounds and acute bone disease, may bring about a pleuritis. Abscesses in the abdominal cavity or involving any of the viscera, and tubercular disease of any part, may be competent causes for this disease.

Pathology.—In the mild forms of pleurisy so commonly occurring the membrane at first is congested, red, and covered with a thin coating of lymph. It loses its natural luster. This occurs also in various forms of acute pneumonia. There are scattered a few fibrinous threads or adhesions. Should the process cease here, it is called dry pleurisy. In somewhat severer cases the fibrin formation is more extensive and diffused over both the pulmonary and costal pleura, causing distinct thickenings. In still worse forms of pleurisy, where the inflammation continues, an exudate is formed which may be in character serofibrinous, fibrinous, or purulent. The last condition is termed "empyema."

The effusion is an inflammatory one and is a distinctly secretory process, not a mere transudation, as in hydrothorax. In mere hydrothorax we have the effect of a simple difference of intravascular tension between the active pressure in the blood-vessels and lymphatics and the negative tension in the thorax.

Inflammation leading to serous effusion presents another factor, the secretory power of the irritated pleural epithelium.

This serum or seropus may be much or little ; it usually contains leukocytes and, possibly, bacteria ; it may be clear, turbid, or opaque ; yellow or green, and thin or creamy. In large effusions the heart is displaced and the lungs are compressed. Oftentimes adhesions are so dense as to seal the two surfaces of lung and costal pleura together, forming limited cavities. This

binding of the lung and ribs may seriously impair functional activity of the breathing organ. In serous pleurisy this encysting is much more common in children than in adults, and may be recovered from. It is almost always encysted in the purulent form. In tubercular pleurisy the inflammatory exudate may cause considerable thickening of the pleural surface as well as an output of fibrin and fluid. Here the effusion may be encapsulated by the adhesions, while the lung is progressively crippled and misshapen by the changes. It is not altogether clear whether an acute pleuritis with serous effusion is a separate disease from pleuritis with purulent effusion, or whether the difference between the two is simply one of degree, differing in the amount of pus-cell formation. Practically, it would seem so; this last form, with the purulent exudation, probably began as such and continued so. The latter is empyema, and the former the true pleurisy.

Symptoms.—The special symptoms of dry pleurisy are pain, sharp, severe, and localized, increased on inspiration; and the painful areas are usually tender to the touch. The pain may be referred to the abdomen. A cough of a tickling character accompanies most cases. In the dry form of pleurisy friction sounds are to be heard over the affected spot, generally of a moist or crackling kind, superficial, and not altered by coughing. When this occurs as a complication of pneumonia, the only evidence may be pain. It generally runs a favorable course in a few days or a week. In the purulent variety there are, usually, constitutional symptoms referable to sepsis. Physical signs are diminished movement of the affected side, bulging of the intercostal spaces, and, if the effusion is large, the measurement of the affected side is increased. If the effusion is considerable, especially of the left side, the apex-beat of the heart is displaced to the right and, possibly, downward.

When pleurisy arises as an acute affection, the clinical picture differs little from that accompanying any acute disease with fever, especially such as affect the chest, as in pneumonia, with which this is usually coexistent. Moreover, one symptom may mask another. There may be a cough from the beginning, accompanied by evidence of pain, such as a cry. These symptoms may increase along with dyspnea, and the later phenomena are those of extreme weakness and emaciation. In the more insidious form the first febrile symptoms subside, lulling suspicion. Older children may complain of pain now and then, with cough, little or more, yet with an increasing pallor and prostration. The fever may be high from the start (105° F.), or vary from day to

day. When the temperature falls, it usually is not quite to normal, and in the following days, should the pleurisy continue, the fever again goes up to 101° or 102° F., remitting in the morning. The pulse is, as a rule, particularly high and tense. Dyspnea is the most obvious symptom. If the chest is touched, there is usually evidence of pain; the child resents being lifted and will prefer to lie on the affected side. Cerebral symptoms may supervene, similar to those in pneumonia.

Prognosis.—This depends on the nature and character of the effusion. In the primary, simple form prognosis is good; in the purulent form it is grave.

Physical Signs.—Inspection reveals lack of movement on the affected side, apparent in even very young infants; this is in sharp contrast to the labored or hurried motions of the unaffected side of the thorax.

When the exudation is extensive, there is also bulging of the affected side; the intercostal spaces are not necessarily prominent: they may be retracted; at least the affected side seems smoother and fuller than the other.

The effusion which accompanies pneumothorax must not be overlooked, though in children this is a rare condition. It is usually purulent, but sometimes serous. The fluid, according to its mobility, obeys more readily the forces of gravity in this connection. It is a matter of remark how little this is true of the ordinary pleural effusion.

Palpation tells little in children, especially in dry pleurisies or with slight effusion. Absence of vocal (or cry) fremitus, partial or complete, over the areas of flatness is of much significance.

The percussion-note over a thickened pleura or mass of exudate is conspicuously dull or flat, but subject to strange and rapid variations in children. Light percussion skilfully applied is required to bring out surface dullness, whereas if this is made too vigorously, the undertones of the distant lung mask this in the thin childish tissues. Koplik calls attention to the peculiarly "wooden" resistance to the percussing finger. On the unaffected side the note is exaggerated, even tympanitic.

Auscultation is an uncertain guide in pleurisy occurring in children. We may hear natural breathing sounds above the fluid level; and below that they are bronchial or diminished or absent, or the respiratory sounds may not be much changed even in a chest filled with effusion. There is more or less accompanying involvement of the lung tissues and bronchial tubes, giving rise to rales and altered sounds, but they change most confusingly. Displacements of the viscera, heart, liver, etc., are not so common

nor so significant as in adults, and are rare in children under three years of age. It is well to note the position of the apex of the heart, however, which is usually pushed toward the sternum by large left-sided effusions. The apex-beat is then to be seen at the ensiform cartilage.

Diagnosis.—In dry pleurisy, seldom occurring in children under ten or twelve years of age, we have symptoms similar to the same condition in adults: sharp localized pain increased on inspiration, tenderness on pressure or movement, and a tickling cough. The pain may not be referred to the affected side, but to the abdomen.

In pleurisy with effusion the reliable signs are: Flatness on percussion, immobility, absence of rales or friction sounds, distant bronchial breathing, absence of vocal (or cry) fremitus, and bulging of the affected side.

From pneumonia it may be distinguished by the lesser temperature and prostration in pleurisy and the mildness of the symptoms generally, other than the sensory ones.

Localized encapsulated pleurisies are evidenced by characteristic changes in the voice or fremitus over circumscribed areas, dullness or altered percussion-note, and especially the wood-like resistance to the percussing finger.

In children the exudate is liable to become suddenly purulent; hence it is imperative to learn at once its character, which any one can readily and safely do by an exploratory puncture with a stout hypodermic needle of large caliber, made with strict care and antiseptic precautions. Outline the area of greatest dullness, wash the skin with soap and water, then with alcohol or bichlorid 1 : 2000. Take a strong hypodermic needle, or, much better, the aspiration needle to be used for both exploration and immediate evacuation, or a needle such as is used for administering the diphtheria antitoxin; drive this quickly ½ or ¾ of an inch (not too far) into one of the intercostal spaces, entering the area of greatest dullness, and withdraw the piston. The nurse must be warned to hold the child firmly, lest by a sudden movement the lung be wounded or the needle be broken off by striking a rib. If no fluid is withdrawn, the needle is to be promptly extracted and a clean piece of rubber plaster or iodoform collodion used to cover the puncture. The absence of fluid in the needle does not mean that there is none in the pleura; hence the operation should be repeated elsewhere, at once or on a subsequent occasion. This little operation is almost harmless; nevertheless it must be done with full precautions. The fluid thus withdrawn should be carefully examined for bacteria. If chain

cocci, staphylococci, or the diplococcus pneumoniæ are demonstrated in a serous exudate, we may be prepared for purulent change (Koplik). If tubercle bacilli are revealed, this is of grave importance; their absence, however, does not prove the absence of tubercular infection. The tubercular form, however, is rare in children.

Treatment.—The treatment of pleurisy is in great measure a preventive one, since it is so constantly a complication of various existing disorders, such as pyemia, the pneumonias, or even of pericarditis and peritonitis, and the acute fevers, rheumatism, and diphtheria. In children the symptoms are exceedingly deceptive, for among them pain is oftentimes absent, although the one most distinctive symptom in the adult. When pleuritis is established, recognized or suspected, the chest should be immobilized; adhesive plaster is objectionable for children, though efficacious, the underlying skin being liable to irritation. A broad bandage or towel adjusted with safety-pins acts better. Cold relieves pain promptly. This may be in the shape of an ice-bag applied dry, or cloths wrung out of iced water, or thick flannel which has been laid upon a cake of ice, this again covered with dry flannel or rubber cloth and fresh chilled flannel thus laid on frequently. If morphin is used to control pain, it is best given hypodermically. Dry cupping is useful if it does not excite. Warm or hot fomentations may do better for feeble children. Quinin has a good effect upon temperature, preventing the rise if used in time. It is best given dry and added to a little simple elixir, or in the form of a suppository. Pilocarpin is theoretically useful, but only suitable for vigorous children. If the heart is weak, cardiac stimulants must be given promptly and in sufficient doses. Calomel is useful to relieve the bowels and stimulate the kidneys, along with acetate or citrate of potassium or the iodids. The use of gray powder, a very ancient remedy, decried by some, is strongly advocated by the English physicians. Cases of serous effusion, if not extensive or causing serious interference with respiration or heart action, may be treated symptomatically and recovery follows. If the acute symptoms progress rapidly and the accumulations endanger life from pressure depressing the liver, stomach, and spleen, accompanied, as it often is, by dyspnea and engorgement of the cervical veins, an operation is imperative and the fluid must be removed. The usual method is by aspiration, repeated if necessary in twelve or twenty-four hours. Occasionally incision and drainage are demanded when the chest is rapidly refilled.

As has been said, it is better to use the aspirator in initial

punctures and thus remove fluid at once. If the fluid withdrawn is deeply blood-stained, it is best to stop the operation. To continue would be to invite more blood to the inflamed lung, which probably underlies the process. If the fluid is blood-stained and no great tension is present, it is again well to cease and rely on medicinal remedies.

Tubercular effusions are rare in children, and if tubercle is the underlying process, it is unwise to interfere surgically, provided they do not produce signs of positive tension amounting to pressure, which would endanger the functions of the other thoracic viscera (Maguire). Tubercular effusions are of rarer occurrence than has been generally supposed.

When the acute symptoms have subsided, the main reliance is upon hygienic and nutritional measures. Indications are: open-air life and moderate exercise, which will aid recovery by improving the general health and the respiratory activities. In adults it is different because of the tendency in them to heart failure.

If adenoid growths of the pharynx are present and cause dyspnea, they may be safely removed to great advantage.

Interlobar Pleurisy.

Interlobar pleurisy is that form of pleurisy which develops and becomes encysted between two lobes of one lung. It is almost always purulent. Normally the pleural surfaces bounding a fissure are simply apposed, but if adhesions cause the margins of the fissure to unite, the interlobar pleura becomes isolated and forms a pocket—a closed localized sac favorable to the development of an encysted pleurisy. This pleurisy may be deep-seated and obscure, and in the beginning may simulate a pulmonary disorder. The pus-cavity may occupy the whole interlobar space or only a part. Sometimes several secondary pockets are found. After adhesions are formed and fluid is effused, the normal situation of the fissure is often entirely altered.

Causes.—Interlobar pleurisy is most often primary. It may be secondary, usually to pneumonia. The primary cases frequently owe their origin to the pneumococcus.

Physical signs are often obscure. Particularly in the beginning the diagnosis offers great difficulties. The signs which usually indicate inflammation of the lung (rales, relative dullness, etc.) are apt to predominate and thus mask the first clinical manifestations of pleuritis. It is only after eight or ten days, when the effusion has grown rather large (at least from seven to nine ounces), that the indication becomes clearer. Percussion now allows one to mark out behind or in the axilla a more or

less extended zone of dullness, corresponding to the interlobar fissure. The persistence of sonorous zones above and below the dull zone, along the vertebræ, at the base of the thorax, and in the semilunar space will permit the elimination of the sero-fibrinous pleurisy. To distinguish an encysted interlobar pleurisy then becomes possible.

Diagnosis.—The principal functional symptoms are three: dyspnea, hemoptysis, and coughing up of pus from rupture of the sac. The dyspnea is more severe than in ordinary pleurisy; hence in the presence of a pleural affection involving intense dyspnea one should suspect first of all an encysted pleurisy. Hemoptysis may be abundant and recurrent. It has appeared sometimes before and sometimes after rupture. It seems due to ulceration of the walls of the cavity. Rupture is much more frequent in encysted pleurisy than in ordinary empyema. It occurs almost always early, and may be predicted a day or so beforehand by the fetid odor of the breath. The symptoms are variable. If the discharge is abundant, the patient is taken suddenly with violent dyspnea, and coughs up quantities of offensive mucopurulent sputum. Most often, however, the rupture consecutive to an encysted pleurisy is not attended with considerable discharge of pus at one time. Once the pus-cavity is empty, it collapses partly and may completely cicatrize. Usually signs of a cavity appear, the fever runs high, sweating is constant, the patient emaciates rapidly, and without surgical intervention a fatal result is inevitable. Medical treatment at this stage is valueless.

PLEUROPNEUMONIA.

Pleuropneumonia is recognized as a separate variety of pneumonia accompanied by an excessive degree of pleurisy, along with exceptionally marked consolidation. The pleurisy in these cases usually arises consentaneously with the pneumonia, or it may follow. The cause is oftenest the pneumococcus. The form is a bronchopneumonia in two-thirds, a lobar pneumonia in one-third, of the cases. The left lung is affected in two cases out of three, the pleurisy being of both lungs, as a rule, in different degrees. Both surfaces of the pleura are found covered with greenish-yellow fibrin, glueing the opposite walls together, affecting also, probably, the pericardium and the diaphragm. The intensity of the inflammation is liable to cause a fatal result early in the course of the disease. When the chest is filled with pus, a condition of empyema results. The exudate may rarely be only serous. Absorption may take place, followed by adhesions,

usually extensive. The symptoms differ little from those of a combined pneumonia and pleurisy and chiefly in the degree of severity of the constitutional symptoms, pain, temperature, and subsequent exhaustion. The auscultation sounds are exceedingly puzzling.

The **prognosis** is naturally bad; infants usually die in the acute stage.

The **diagnosis** from empyema or simple effusion is not so difficult if punctures are made. It is difficult to withdraw the fluids unless a pocket be accidentally punctured.

HYPOSTATIC PNEUMONIA can not be readily diagnosed, but commonly accompanies death in infants from chronic or wasting disease, particularly marasmus. The lesion postmortem is seen to be confined to a superficial strip along the posterior border of both lungs, not involving the deeper structures, as in atelectasis. This should not be regarded as accounting for the death. There is seldom dullness on percussion, the only sounds being fine, moist rales.

GANGRENE OF THE LUNG occasionally occurs in feeble children of poor nutrition, usually under three years of age, and following the course of depressing diseases, particularly bronchopneumonia and measles. The immediate cause is some mechanical shutting-off of the circulatory activity in a portion of the lung.

The distinctive symptoms are the gangrenous odor of the breath and the expectoration of fragments of decomposed lung tissue. Death, however, is liable to occur before these evidences are clear, and the diagnosis is usually made from postmortem findings.

PULMONARY COLLAPSE (ACQUIRED ATELECTASIS).—A condition of collapse may come upon areas of a competent lung during the progress of pulmonary disease or owing to causes which profoundly disturb the lung circulation or the pressure of air in the lungs.

This may arise from compression or obstruction. Collapse due to compression commonly accompanies pleuritic effusion or pneumothorax, pericardial effusion, cardiac enlargement, deformities of the chest, and thoracic or mediastinal new growths. This may be partial or complete, and becomes less remediable the longer it remains, especially if there exist dense pleuritic adhesions, which last may be the chief barrier to reexpansion. Collapse from obstruction is due to two factors—blocking of the bronchial tubes, great or small, and incompetent respiratory vigor. Holt says that this first factor has been greatly exaggerated. If the lumen is narrowed, the stenosis is most liable

to result in emphysema. When a bronchus is obstructed from any cause, usually from a foreign body or from external pressure preventing the entrance of air, that portion of lung beyond this point becomes slowly collapsed; if a primary bronchus, the whole lung; if a lobar division, the whole lobe; if a bronchiole, a small contiguous area. The collapsed portion becomes depressed below the normal surface, is of dark-red color, highly vascular, and resembles pneumonia—in which it may result. Holt, also from special observation, declares that the development of emphysema is much more likely to result from stenosis, due to bronchitis of the smaller tubes, etc., rather than to atelectasis.

Collapse of areas of the lung may come on slowly and generally in feeble infants, rachitic and otherwise depressed, accompanied by bronchitis resembling congenital atelectasis, with much the same phenomena. The symptoms are rapid respiration, dyspnea on inspiration, sinking in of the chest-walls, cyanosis, and impaired peripheral circulation.

EMPYEMA.

Empyema or purulent pleuritis usually accompanies or follows pneumonitis, especially pleuropneumonia, and is more common in children than in adults. It may complicate or follow the acute infectious diseases and especially tuberculosis (oftener in children several years of age), and is a sequel of pyemic states of various sorts, umbilical sepsis, and bone or joint inflammations, appendicitis, or purulent peritonitis.

Bacteriologic research has done much recently to add to our knowledge of the causes. The pneumococcus is found in most purulent pleural exudates, notably those following pneumonia; next common are the pyogenic agents, streptococcus and staphylococcus, alone or with the pneumococcus; and, finally, the tubercle bacillus is often present, but not so easily demonstrated. It is most rare for empyema in a young child to result from a serous effusion which has been gradually converted into a purulent one. Empyema usually succeeds that form of pleurisy in which there is first an exudation of fibrin, with an excess of pus-cells. Sacs or pockets may exist or form by slight adhesions in the pleural cavity, into which the pus is poured and collected. The subdivisions are large or small, but they tend to become larger and are found usually posteriorly, but also elsewhere in the chest. The sacs may be divided by septa; hence the evacuation of one does not empty the chest, except at that point. The pus may not be all, or nearly all, at the bottom of the chest, but

exist merely as a line of half an inch or so in depth at the middle or upper part.

Even when the accumulation is great, the lung does not float on the fluid, but is surrounded by it, causing a compression, displacing the heart, diaphragm, and the abdominal viscera, and there results a bulging of the chest-wall. If the lung is thus interfered with for a long time, its elasticity is liable to be much impaired, adhesions grow dense, and subsequent expansion never becomes perfect. Pus may burrow into a bronchus and discharge. Also a chronic change takes place in the parenchyma of the lung, producing the so-called "fibroid phthisis." Early and adequate surgical relief removes the possibility of serious damage. Pericarditis is a serious complication in younger, and pulmonary tuberculosis in older, children. Endocarditis rarely occurs; this is true also of gangrene of the lung and thrombi.

Symptoms.—The symptoms of empyema are similar to those of a pleurisy with effusion; sometimes less marked, but, as a rule, giving evidence of greater systemic depression, a higher temperature range coming on suddenly and sometimes irregularly. Along with these are found the evidences of effusion in circumscribed areas of consolidation, or narrow tracts, or extensively. Also there are the usual symptoms of pulmonary disease: more or less cough, dyspnea, pain, etc. The pulse is rapid and seldom strong, but not so weak as might be expected. Empyema in children is much more insidious than in adults—is, indeed, oftentimes unsuspected in spite of most careful observations. In long-standing cases there are seen marks of chronicity: clubbed fingers, swelling of the feet, urinary changes, etc.

Diagnosis.—The history of the case, the antecedent or accompanying conditions, will point the differences, as a rule, between a simple serous pleural effusion and the purulent form. "If the child be under three years of age, the fluid is almost certain to be purulent; and from the third to the seventh year pus is much more often found than serum" (Holt). The exploring needle should be promptly and frequently used, as early differential diagnosis is most important for treatment and prognosis. Pus may not flow from the needle for many reasons—because the needle is too small or short or is pushed through too far, or the pus may be too thick or may be sacculated, etc. Hence repeated explorations are to be encouraged under due precautions. (See Pleurisy.) A study of the blood will aid the diagnosis. (See Diseases of the Blood.)

In empyema there is flatness over the whole lung or lower

half, with no rales or friction sounds, and the heart is displaced. Auscultatory phenomena are misleading; the character of the breath-sounds is feeble, and breathing is distant and bronchial.

Prognosis.—When the case is treated promptly and surgically, the outlook is favorable to a continuance of life. If the condition of the patient is good when the disease begins, it is still more favorable, though age is an important factor; so is the nature of the essential cause and the early or late stage of the malady.

Perfect recovery can be expected in favorable cases, and that without chest retraction or spinal curvature. When these deformities are marked, there have been errors of treatment, of which long neglect is the chief. Cases not treated, or not until too late, often die from exhaustion, sepsis, perforated bronchi, choking, tuberculosis, or visceral degeneration.

Treatment.—Pus in the pleural cavity must at once be evacuated by incision and drainage. The aspirating needle is of great service to establish the diagnosis, but is of no value in treatment.

If there is difficulty in introducing a rubber drainage-tube of sufficient size to permit the pus to flow freely, a small portion of one or more ribs should be resected. The pleural cavity must not be washed out, as experience has shown this to be a highly dangerous procedure. Immediate collapse and death of the patient have resulted in not a few instances. If, after a time, the lung does not expand and the discharge of pus ceases, an extensive resection of the ribs should be performed.

Estlander, Keen, and Schede have devised operations of this character. This allows the chest-wall to sink in toward the collapsed lung, and adhesion occurs between the two pleural surfaces.

Delorme has recently had success in four cases by an improvement on these methods. He resects the ribs in line of the skin incision, and turns them back with the soft parts as one flap, removes the thickened pleura from the collapsed lung, and returns the flap to its place. His operation leaves the lung in a condition to regain its normal expansibility.

Cases will be met with, however, in which an operation can not be performed. The family may refuse, or it may occur on both sides of the chest. Empyema occasionally does get well by resorption. The great danger is that of septic infection, carrying acute inflammation elsewhere, or resulting in a depressing septicemia.

Repeated aspirations have been known to effect much relief or partial recovery.

CHAPTER XIV.

DISEASES OF THE NERVOUS SYSTEM.

NERVOUS MANIFESTATIONS IN THE DISEASES OF CHILDREN.

A subject which often fails to engage the attention of practitioners of medicine in dealing with the disorders of infants and children is the nervous manifestations often encountered. If these could be more clearly understood, they would furnish guiding lines enabling us often to avert threatened calamities.

The equation between functional activities and external conditions which is called health depends primarily upon two factors —nervous control and cellular integrity. The chief item in equipment of the infant to maintain health is capacity to resist those counterinfluences which perpetually assail. To this resistance we trust in a rather blind and confiding fashion, and our efforts are usually confined to endeavors to adjust the more obvious external conditions of life to the varying needs of the organism and in the use of remedies which, according to our knowledge of physiologic influences, best modify and control the conspicuous departures from normal processes. The young child is known to be peculiarly susceptible to influences which disturb normal equilibrium, and hence it suffers to a much greater degree from even the lesser irritations than adults.

Two influences stand prominent in forming this lessened resistance in infancy and childhood—cellular instability and the incomplete development of the nervous system. Along with these there are many other factors which bear relation to embryonal conditions, merging into normal attitudes which afford valuable indications to the student of vital phenomena and which the average medical student omits to estimate with sufficient care.

It would seem that among even the better educated and more capable practitioners the child is looked upon too much as merely a small human being, for whom a modification of ordinary remedial measures is required, proportioned to the age and weight, but

calculations as to age and developmental processes bear little or vaguely upon practical conclusions.

The older writers—many of them at least—keenly appreciated these facts and described admirably many infantile phenomena which could not be explained by the meagerness of the then state of physiologic knowledge. Later observers have given much study to the elucidation of the phenomena thus recorded and have amplified their descriptions. Where it becomes necessary to study conditions of obscurity, it too often transpires that no notice was taken of phenomena, come and gone, through which alone it would have been possible to trace the steps of disease, which then presents the utmost complexity.

Perhaps in no department of nosology is this more apparent than in the group of conditions which are known as disorders of the nervous system. However, long before we reach this branch of medicine, or when diseases of the brain or spinal cord come in for attention, there are many states dependent upon temporary disturbances of nervous equilibrium which require estimation. For instance, along with commonly recurring symptoms which point to obvious disturbances of the digestive or respiratory or other organs, there may or may not be evidences of neurosis; in proportion as these arise in children of vigorous constitution, good heredity, and wholesome upbringing—in short, of sound cellular stability—they are fair indices of the gravity and extent of the disorder. If, on the contrary, they appear in the persons of those whose outward seeming is good enough, but concerning whom it can be learned that they are of neurotic inheritance or vicious environment, or both, then we may still assume that the infection or disease is exerting serious influence upon an irritable organism, and the prognosis is far worse, not only as to the outcome of the immediate attack, but revealing latent weakness. Again, it is possible these neurotic phenomena are such as may be expected to repeat themselves in like or similar fashion upon the recurrence in these enfeebled bodies of even slight evidences of disease, hence not of deep significance; or, finally, they may indicate that latent tendencies or lesions are thus placed in evidence and enable us to predicate dangerous amplifications in the future.

Owing to the imperfect state of development of the nervous system in the earlier months or years of childlife, the existence of paralyses is not so readily determined; and such evidences of defect or disorder in the central nervous organization are often not observed until their progress is a serious disablement. Such movements as are made by babies are usually of reflex origin,

and, being not consciously produced, they are less capable of control and not fully nor accurately performed. In a fair proportion of children, moreover, there are inherent defects of development other than those due to normal developmental delays. These hereditary variations from the customary processes of growth in some instances are overcome in due time, producing, it may be, slowness of growth in functional activities or departures from normal types. The earlier these traits are recognized and placed under suitably modifying influences, the better the result.

To discover evidences of neural disturbance or disease, it is imperative to observe the child while entirely naked; and while thus closely inspecting, note the smallest aberrations in structure, proportion, or voluntary movements. This requires the critical eye of a trained artist, only to be acquired by much practice, coupled with large knowledge of the progressive stages of outline and proportion which illustrate normal growth. In the majority of instances the child will be subjected to this scrutiny if there is some disorder noted by the parents, and these phenomena under consideration must not escape our attention or be thrust aside by the others.

The unstable state of equilibrium in the cerebrospinal cells in the young child renders exaggerations of motion even more common than those of sensation. The lesser degrees of motor exaggeration, such as tremor, are comparatively rare and most difficult to account for. Spasms are more frequently encountered, but are often so slight that it requires very nice and watchful observation to detect their earlier manifestations. A mother can readily see what is invisible to the most shrewdly observant physician or nurse, and her testimony is always to be courteously accepted; not so her conclusions. Spasmodic states are often of the gravest significance, and much importance must be allowed them in any clinical history. The indications for treatment thus evidenced are most clear, and these are absolute rest for mind and body and the prompt removal of whatsoever source of irritation can be found to exist, whether it be mechanical, or toxic, or environmental. Attention of this sort may prevent the occurrence of the larger motor excitement, convulsion, which is always a grave symptom, and increasingly so if prolonged or repeated. The conclusion to be reached in estimating the gravity of the significance of any of these motor excitements brings us to one or another of the horns of this dilemma. Either the underlying disease process must be of an overwhelming character, or the nature of the cellular integrity of the child is inherently unstable. Some children and certain families are

thrown into spasms or convulsions by very little things, whereas others, even under closely analogous circumstances, never manifest any perturbation of the centers of motion. Disturbances of sensation also are subject to many variations, according to the degree of the individual stability. Undoubtedly some children —indeed, some families and races—are relatively insusceptible to pain and differ even more widely in their capacity to endure. The greatest stoicism or Spartan fortitude is sometimes exhibited by very young children, even though their constitutions suffer in consequence. Others cry aloud at the least element of discomfort, which is readily elevated by them into a conception of agony. It is needful, however, to be on our guard against ignoring evidences of pain, and if possible determining its source and character. Bear in mind that children are most susceptible of suggestion and easily acquire and can be made to relinquish conviction as to disturbances of sensation. It is difficult at all times for children to differentiate between the paresthesias, and it is a great puzzle to differentiate or to apply tests for sensory variations. The conditions producing alterations in sensibility are rare in infancy, excepting those producing tendernesses, such as rheumatism, neuritis, the inflammations, as of scurvy, rickets, or Pott's disease, or the simpler problems, as injuries or abscess.

Anesthesias are observed to follow or accompany the palsies of the infectious diseases. When pain accompanies paralysis in a lower extremity or the trunk, we must suspect Pott's disease, whether deformity be discoverable or not. Localized tenderness along a nerve-trunk arouses fear of a neuritis. In an epidemic of poliomyelitis reported by one of us, this feature was common to most cases.

A study of the pupils and of the fundus of the eye is important and liable to be omitted unless the physician is himself familiar with the use of the ophthalmoscope.

Disturbances of speech should receive careful attention. The interference with the development of the speech center is not so serious a defect in a child as in an adult; for in them the corresponding hemisphere may take on and develop full function.

Aphasia may be mental or physical, or due to defect of the organs of speech, and is commonly produced by adenoid growths of the pharynx.

Always make the electric examination last, because a child will frequently be in a perfectly good, gentle temper until the electricity is tried, when frequently it objects and becomes unmanageable, and it is impossible to secure the clinical findings.

The knee-jerk is a variable phenomenon in children, though

readily elicited by careful methods. It is easily exhausted by repeated blows, and disappears in conditions of exhaustion. It is greatly exaggerated during states of tension, from fear, or struggling, or crying. To determine its significance, studies must be made at different times. Ankle-clonus does not occur in the very young. Contractions are almost certainly evidences of organic disease.

The Babinski reflex (see p. 503) is normal in the very young, although the dividing-line has not yet been determined.

THE NEURON.

Waldeyer gave the name neuron to the nerve-cell as a unit. The concept of the neuron theory, as held by many neurologists and anatomists, but disclaimed by others, is here presented to enable the student to get a clear idea of the very fascinating views which it embodies and suggests. A neuron consists of three essential parts, the first of which is the nerve-cell, as formerly described. An example is the cell of the anterior cornua of the spinal cord. This cell has many processes and two functions, the first of which is to receive impulses and the second is to pass them on. The cell receives its impulses from a number of protoplasmic processes which divide and subdivide into a fine meshwork of fibers called "dendrons," which may be regarded as the second part of the neuron. These dendrons convey impulses to the cell and are described as cellulipetal in function. The third part of the neuron is a slender, straight process which leaves the cell in much the same manner as do the dendrons, but, unlike them, does not divide. It sends off fine side-shoots which are called collaterals, which are in all probability associational in function. This slender fiber is the axis-cylinder and is efferent in function, being spoken of as cellulifugal.

The axis-cylinder passes to its destination, which is either the dendrons of another nerve-cell or the specialized cells in a muscle. In the latter case it proceeds to the muscle, in company with many other axis-cylinders, in the form of a nerve, and when it has reached its destination, breaks up into a fine arborization around an end-plate.

Before speaking of the manner in which the axis-cylinder ends in the dendrons of another neuron, it will be necessary to state briefly the neuron theory.

In the cortex of the Rolandic area of the brain there are goodly sized nerve-cells whose axis-cylinders or neuraxons pass down through the internal capsule and pons into the pyramidal

tract of the medulla. In the medulla they decussate and pass more dorsolaterally down the cord as the crossed pyramidal tract. If such a cell is located in the arm area of the left side, by the time its axis-cylinder has reached the cervical enlargement, being then on the right side, it passes to the interior horn of the gray matter and breaks up into a fine basketwork of fibrils in close juxtaposition to, but not joining or anastomosing with, the dendrons of the anterior cornual cells. We speak of these cortical motor neurons as forming the upper segment, and the neuron of the anterior cornual cell as being the lower segment of the motor tract. The impulse is transmitted simply by contact and not by anastomosis.

It will be seen that the upper segment is a crossed tract, and the lower segment is a direct one. So much for the motor neurons.

The lower sensory neuron has the cell in the ganglion of the posterior roots and its dendron running from the periphery to it. Its neuraxon enters the cord by the posterior root and divides into two portions—one ascending and one descending. The ascending portion passes up the same side of the cord into the medulla, ending in the posterior nuclei of the same side. The lower sensory segment is, therefore, a direct tract. The descending portion of the neuraxon from the posterior ganglion ends in the gray matter of the same side of the cord, and possibly plays a large part in reflex production. The upper sensory segment starts in the posterior nuclei, and decussates at once the neuraxons, passing to the cortex. Exactly where the neuraxons of the upper sensory segment end is not determined, but it is supposed that they too end in the Rolandic area, this area being sensorimotor in function. The upper sensory segment is a crossed tract.

REFLEXES—THEIR PHYSIOLOGY AND SIGNIFICANCE.

The reflex act consists in an afferent impulse carried centripetally along an afferent nerve which is purely sensory or mixed; and of a center in the spinal cord for the spinal nerves, or certain centers at the base of the brain in the case of the cranial nerves. Then there is normally the efferent impulse passing centrifugally from the center along a purely motor or by the motor fibers of a mixed nerve.

The physiologic cycle is termed a reflex arc, and must be intact anatomically and functionally to permit the reflex act to pass normally along it, which, in working harmony, constitutes

the major part of the functionation of the new-born infant; hence the reflex phenomenon in children sustains an important relation to their vital actions, and this gradually lessens in activity as the brain develops and the concept and precept centers become established.

The reflexes may be divided, clinically, in children into:

1. Somatic, or those related to the bodily organs, as in the vesical reflex controlling urination; the sucking reflex sustaining pretty much the entire distribution of energy which causes the infant to acquire nourishment from the breast; and the respiratory reflex, as instanced, for example, in the dyspnea which first excites the act of breathing after the infant is brought into the external air. A number of these somatic reflexes are of essential importance in the development of the child, and especially do these sensorimotor activities play a vital rôle in nutrition, respiration, etc.

2. The skin or superficial reflexes are those sensorimotor phenomena which arise from a stimulation of the nerves of the skin, and are divided variously into the orbicularis, epigastric, abdominal, cremasteric, etc., according to the topographic distribution of the nerve-fibers entering into the particular reflex arc. These reflexes may be exhibited by a gentle irritation of the skin—examples, cremasteric, abdominal, etc.

3. The deep or muscle reflexes are those in which the reflex arc lies at its distal end, further away from the surface of the body than those of the skin, and require a firm impact of the external stimulus (such as a blow upon the ligamentum patellæ) to develop them. Contraction of the masseter muscle of the lower jaw, brought out by striking down upon the mental process of the inferior maxilla when the mouth remains passively open, is designated the chin reflex. The motor impulse causes contraction of the masseter muscles, and hence there follows a quick, jerky, partial closing of the mouth. Other deep reflexes are the elbow-jerk, the knee-jerk, the ankle-jerk, and the crossed reflex or contralateral adductor spasm, etc., all more or less familiar to the student.

4. The concept reflexes are those caused by thought, and have no true arc, but are afferent only: as, for example, the contraction of the pupil in accommodation.

The so-called muscle-jerk is merely a deep reflex brought out by tapping directly over the belly of the muscle, as exhibited readily on the biceps of the arm, and produces a contraction or humping of a limited portion of that particular muscle.

Modification of Reflexes.

As to the modification of reflexes in health or disease, it will be seen at a glance at this diagram that anything which cuts off, stimulates, or inhibits action or fibers at any point along the arc will thus affect the reflex involved. This will be shown as we proceed. It must be remembered that the brain acts as the normal inhibitor of all reflexes.

As indicated above, the child is influenced in growth and development most largely through reflex action, and it is at all times more sensitive than is the adult, whose nerve protoplasm has become matured and whose neurons have become more stable. Inhibition, abolition, increased, excessive, spastic, and tetanic are terms descriptive of modification of reflexes.

Significance of the Reflexes.

The significance of the reflexes in childhood is, therefore, shown to be of the utmost significance and importance. The variation and vacillation of cell activity in early life are to be always borne in mind. By a study of large numbers of healthy and of abnormal children the full clinical significance of the various reflex acts can be estimated. Then the factors of heredity and inheritance must be carefully weighed before an opinion can be formed of the quality and significance of the reflex phenomena in childhood. Hence, while we note the intricacy of the problem, it can only be solved by a fair knowledge of the physiology, etc., and the personal factor of the observer, but it is always important for the attending physician to note the conditions found, which will serve as valuable data for the use of the consultant who may be called upon to give an opinion in difficult cases.

Excess of Reflex Action.

Cerebral.—In mental diseases of active type, as in mania, the reflexes are increased. If there is a generalized increase of the skin and deep reflexes, but not to the degree of spasticity, it is significant of a central irritation, whether it be from a cerebritis, meningitis, or a pressure from subarachnoid effusion or the like. If the irritation continues or increases, there are liable to follow convulsions, local or general, followed, it may be, by palsies, transient or permanent. If recovery ensues, a spastic condition of the limb may remain, with the development of adventitious reflexes (as ankle-clonus) and, still later, contractures which may demand surgical help by tenotomies, etc. Passive motion and

other well-directed manipulations benefit these, not over the limb, but the center thus affected. A complete freeing of the controlled tendons by either of these means benefits the whole affected region or tract. This is abundantly illustrated in the case of sufferers from cerebral diplegias in whom the cerebration is also improved by mechanical measures. An excess of cortical pressure will lessen or obliterate reflex action by obtunding the conductibility of nerve-fibers. In chronic hemiplegias increase in reflex activities, with ankle-clonus, occurs on the affected side. In tetanus, hydrophobia, transverse myelitis, and insular sclerosis the exaggeration of the superficial and deep reflexes is associated with the other symptoms of these diseases.

Spinal.—Increase of reflexes due to lesions of spinal origin is to be differentiated by excluding the semeiology of cerebral disorders and by including all signs of spinal disease.

Lateral sclerosis is the rare form occurring in childhood and causes spastic reflexes, especially in the lower extremities, but may extend to the arms or even to the head and neck. In this case athetoid movements of the hands or nystagmus would be likely to supervene, signifying a disseminated sclerosis and the resulting irritation which has occurred.

Diminution of Reflex Action (Sensorimotor).

Cerebral.—In apathetic mental disease (melancholia) the reflexes are lessened. As stated above, extreme pressure within the cranial cavity, or within the spinal canal, will lessen or cut off the reflex act. In degeneration of muscles or nerves from inherent disease or from disease of the contingent peripheral neurons, as shown by the reversal of the galvanic formula (reaction of degeneration), the reflexes are greatly lessened or abolished. Therefore, to mention specific diseases, such as chronic myelitis with complete degeneration of the cord or of the sensory or motor roots of the spinal cord, the reflexes below the site of lesion are lessened or wanting. In the purely motor sphere we have the reflex wanting in anterior poliomyelitis, in paralysis of a motor nerve, and in the muscle dystrophies and in neuritis.

In the sensory sphere in childhood we have the reflex lessened or absent in hereditary ataxia or in the rare precocious true posterior spinal sclerosis, and in injury of a sensory nerve, in which case anesthesia will follow, or in neuritis of a mixed nerve, when also motor palsy will be a symptom present.

Some terms used in regard to reflexes as a whole:

"Babinski's sign" is an extension of the toes, when the rôle

of the foot is imitated, rather than the normal flexion of them—supposed to be indicative of disease of the pyramidal tracts. This new sign has not been accepted by many writers.

The muscular sense is the reflex which causes appreciation of size and position and the combined movements of a whole or part of the body.

Inhibition of a reflex refers to lessening of the reflex act.

A capricious reflex is one that is not constant in response to stimuli.

Reinforcement of a reflex implies a quickening or an increase in the rapidity or range of the reflex act, and is due to impulse given by a simultaneous motor act, as in "making a fist," or in concept, reinforcement, as by thinking intently upon some subject at the time the reflex is brought out.

MOTOR EXCITEMENTS.

Disturbances of motion, where movement is in excess and more or less beyond control, are called convulsions, spasms, choreic movements, tremors, and automatic movements.

Local spasms may occur as disturbances of motion in the muscles of organic life, such as esophageal, rectal, urethral, and the like. Vomiting is a local spasm; so are certain forms of nervous cough. Spasms of voluntary muscles produce such effects as laryngismus stridulus, child-crowing, and the like.

Tremors may be choreic, hysteric, and that form seen in habit chorea, as well as due to organic disease. Choreiform movements may be local as well as general. Automatic movements are of rather wide variety, due to hysteria, habit chorea, and such like disturbances, partly organic and mostly functional, occurring sometimes in epidemics.

CONVULSIONS.

A convulsion is a temporary overflow of motor impulses, producing purposeless muscular contractions, alternating with relaxations for shorter or longer periods, attended by more or less loss of consciousness. If the alterations are rapid, the form is called clonic; if slow, the contractions being maintained for a variable time, it is called tonic. A spasm is a more or less rapidly alternating contraction and relaxation of certain muscles or groups of muscles affecting a limited portion of the body; it is essentially local, and, as a rule, does not involve the centers nor disturb consciousness. A tremor is a rapid rhythmic vibra-

tion in the muscles. Convulsions may be epileptiform, hysteroid, or tetanic. In epileptic and hysteroid convulsions consciousness is disturbed because these emanate from the brain centers. In the tetanic form this is peripheral, and not central. In epileptic convulsions consciousness is lost or severely imparied, as a rule. In hysteria this is also true at times, wholly or in part, but is not to be expected. Local spasms may occur as disturbances of motion in the muscles of the vital organs, such as esophageal, rectal, urethral, and the like. Vomiting is a local spasm; so are certain forms of nervous cough. Spasms of voluntary muscles in young children produce such alarming effects as laryngeal spasm, or laryngismus stridulus, child-crowing, and the like.

Automatic movements are irregular, involuntary muscular acts, more or less coordinated, and simulating voluntary acts.

Infantile Convulsions.

Convulsions occurring in young children constitute a symptom, not a disease. They vary widely in severity, beginning locally and becoming general, or they may prove to be overwhelming motor discharges so intense as to cause serious disablement or possible death. Modern writers deny the gravity of infantile convulsions, so far as immediate results are concerned, but readily admit that very grave subsequent effects often follow.

Symptoms.—Almost any one of moderate intelligence will readily recognize a well-marked convulsion or even a convulsive tendency; but it is of the utmost importance that the first observer shall carefully note and be able to relate accurately the starting-point and phenomena of progress, the degree of severity, and the length of time it has persisted. On these facts will depend a proper diagnosis of the character and seat of the irritation. The slightest twitching of the thumb may indicate irritation or disease near the thumb center. So twitchings of the eyelid or movements in and around the corners of the mouth point to central disease. Unilateral convulsions do not necessarily indicate a local lesion, although they form a fair ground for suspicion of focal disease. There is usually some prodromal symptom, more or less brief, such as slight twitchings, alluded to in the muscles of the extremities or face, a general restlessness, and startings upon slight irritation from touch or noises. Immediately before the convulsion there is often pallor, a fixity of the eyes, or they may be rolled up into their orbits; these slight, isolated movements may pass into convulsive twitchings, extending rapidly over the entire body, or shifting from one side

to another, or from one limb to the opposite one, along with, or alternating with, movements in the face or head, retraction of the head, or rolling of the body over to one side or the other.

A succession of grimaces due to contraction of the facial muscles may be the only early change seen, or, later, the hands may be clenched, the thumbs being buried in the palms; the great toe extended downward—"carpopedal spasms"—or these phenomena again may be followed by a general commotion, frothing at the mouth, disturbed respiration and pulse, slow or rapid, usually irregular, sweating of the forehead, and blueness of the lips and face. The sphincters may become relaxed, urine and feces being passed involuntarily. After the fit there is usually evidence of prostration, and temporary palsies not infrequently follow, due to exhaustion of the nerve centers. One attack of convulsions is commonly followed by others, exhibiting an increasing susceptibility. Convulsions coming on in a child previously well point to some acute disease of exceptional severity, or possibly acute meningitis. Convulsions occurring in most forms of brain disease are not usually accompanied by marked temperature rises, but are liable to exhibit pupillary changes, strabismus, rigidity, or localized palsies.

Causes.—Convulsions, local or general, arise in excessive and irregular discharges of nerve centers in the cortex or base of the brain. Nothnagel suggests a convulsive center in the pons.

Experiments by Suschtschinski and Wyrubow have shown that the convulsions caused by irritation of the pons are not the effects upon a convulsion center, but due to the transmission of irritation to the cerebral hemispheres and especially the motor cortex.

The seat of discharge in convulsions is presumably in the ganglion cells of the brain, and the molecular disturbances in these cells necessary to the morbid discharge are determined either by direct irritation of those centers or reflexly through peripheral irritation. The phenomena have to do with exaltation of the lower centers or loss of inhibition in the higher centers, or both.

In infants the nervous system is structurally immature, but in process of rapid development. Even after structural completion time is required to attain functional stability.

At birth the lower centers only are developed; hence control is limited until the higher centers become competent to exert inhibition. In the earlier months of life convulsions are common, progressively less so after birth to the first year of life (Kassowitz), and are rarer after the second year.

It is unusual, perhaps impossible, for a healthy child to suffer from convulsions unless the exciting cause be overwhelming, such as trauma, an intense irritant, or poison. Convulsions readily occur in children of unstable equilibrium. This dangerous condition may arise from inheritance or become acquired, and is of very varying degree. One convulsion predisposes to another, and the habit may become fixed.

Some families are especially prone to suffer ill effects from motor excitements, or their infants offer but feeble resistance to excitants, be these physical or psychic. Again, individuals vary from time to time, and are rendered susceptible by depressing causes, nutritional and emotional, as well as by the onset of definite disease.

Exciting causes are chiefly reflex from peripheral irritations, inducing overactivity in convulsive centers. The history of many of these must be received with caution, since deeper causes can usually be found where careful search is made, more probably several causes acting together: vasomotor instability, temporary or prolonged; states of anemia; variations in blood supply and quality, along with states of certain special nerve irritation, as that of the fifth or of the gastro-intestinal supply, and the extremes of heat and cold and rickets, produce conditions which react in convulsions from relatively slight exciting causes.

What part is actually played by disordered dentition is not determined, but the weight of modern evidence is against this being of great significance. Some go so far as to assert that it is absolutely *nil;* others admit that it exerts some positive influence. Certainly it is not shown to be a large factor. The lancing of the gum over an approaching tooth often relieves the spasm. In the same category of doubtful causes may be mentioned the presence of intestinal parasites, where removal is, however, of practical value.

Of the determining causes, by far the most important is the use of improper food, unsuited in amount, kind, or condition to the needs of the young child. This acts often as both fundamental and exciting cause. Milk from a mother or wet-nurse may be vitiated by various causes,—fatigue, emotional,—or it may act as a medium of poisons,—such as alcohol,—and has been known to thus cause convulsions.

Other determining causes besides the visceral sensory distribution (gastro-intestinal) are such as disordered dentition (fifth nerve); the various infections, especially whooping-cough, syphilis, scarlatina, and the other exanthemata; ptomains and leukomains, uremia, malaria, heat, cold, febrile states, burns,

fatigue and depressing influences, blood loss, shock, emotions, fright, anger, etc. Of poisons, some are the toxins generated within the organism alluded to, and others are swallowed, among which should be borne in mind lead, alcohol, etc.

Interesting cases were reported by D. D. Stewart among a series of children poisoned by lead used as coloring-matter in cakes. Meunier reports cases of convulsions caused by breast-milk where the nurse took large amounts of alcohol. Many of these cases are aggravated by meteorologic conditions, especially of hot weather in summer. It has long been believed that convulsions frequently occur as a prodrome in pneumonia, but Gossage and Coutts show a series of 166 cases with this symptom in only 8, or 4.7 per cent.

Convulsions—and these the more serious ones—are also due to various forms of cerebral disease: hemorrhage, internal pressure, as from rapidly increasing hydrocephalus or abscess, and emboli and thrombosis, and, above all, rickets. Only a small proportion of cases of convulsions, however, are demonstrated to occur in children who have evidences of rickets. In them motor disorders are more likely to be tetany and laryngospasm. The brain presumably suffers from malnutrition in all these disorders, and to this the instability is due.

Prognosis.—In estimating the dangers resulting from convulsions it is necessary to consider the nature and extent of the cause. In children of a markedly unstable nervous equilibrium a convulsion may mean little or nothing. Moreover, moderate convulsions occurring in young infants are of small import. Fits appearing as prodromes of acute febrile diseases are rarely serious, and may not even indicate an unusually severe attack of the disease. When they occur after the establishment of the characteristic features of the disease, they are of deeper significance, and may indicate the oncoming of nephritis, meningitis, or other grave complications. Those points on which one is likely to base a serious prognosis are extreme prolongation and frequent recurrence of the convulsions; also profound disturbances of the circulation, stupor, or subsequent prostration.

Gossage and Coutts lay great stress on the facts that the danger of future neurotic manifestations in children who have had convulsions has been much underestimated; predisposing are of more importance than the exciting causes; and that the slighter exciting causes will not produce convulsions except in children so predisposed. Statistics were produced at the 1899 meeting of the British Medical Association, showing that over one-half of the patients who had exhibited convulsions in infancy were

found to suffer from some form of neurosis. And these were not so much to be ascribed to the malnutrition of the nervous system in infancy or to damage during the convulsive stage as to congenital faulty development. This is particularly true in children of gouty, nervous, rheumatic, or diabetic parents, and it is among those in whom such a diathesis is known to exist that any extreme of reflex irritation must be repressed or it will result in a nervous explosion.

Treatment.—The treatment of convulsions divides itself in two very unequal parts: to overcome the symptom and to master the underlying condition. The indications, for the first, are to hasten to the case with all speed, to secure promptly various items of equipment, which may, any or all, be needed, but the absence of any one of which may cause serious embarrassment, possibly danger to life.

A severe or continued condition of convulsions may produce serious damage to remote organs and tissues. The explosion may be overcome by the inhalation of chloroform, which, in the condition of such a state of nervous exaltation, is quite safe. To this may be added, with advantage, nitrite of amyl and sulphuric ether. The mixture we have used for years most successfully in the paroxysm of pertussis is equally applicable here: amyl nitrite, one dram; spirits of chloroform, three drams; sulphuric ether, five drams. It is well to loosen the clothing, or, better, to remove it promptly. Thus many important points may be revealed. Often the child will be found in a bath of hot water; perhaps mustard is added. In the excitement this may have been so hot or irritating as to cause damage, and it is best to remove the child at once, and it may be necessary to investigate the condition of the skin and apply emollients. If not in a bath, it is often useful to apply a mustard pack—which consists of one teaspoonful of dry mustard rubbed up with one ounce of water and added to a quart of hot water, and into this a sheet or bath-towel is dipped and wrapped around the child. After this has been applied for a suitable time, or during the continuance of it, a careful search should be made for various sources of reflex irritation. The chief of these may be found in the digestive tract, and the next routine procedure to be recommended is to apply a cleansing enema. This enema serves several valuable ends in removing feces or undigested food, and, if hot, aids in stimulating capillary relaxation. If the temperature be found high, this can be followed, with advantage, by a cool enema. If subnormal, as is the case frequently in the convulsions following summer diarrheas, a salt enema supplies fluid by imbibition, or hypodermat-

oclysis may be even better. We have seen lives saved by this. In hyperpyrexia cold to the head is in most cases a useful measure. If congestive states are pronounced, local blood-letting by leeches is of much use, and is recommended by Baginsky and others. If the cause is due to intracranial tension or acute hydrocephalus, lumbar puncture is a useful and safe measure, and this we have done with great satisfaction many times. Baginsky recommends local blood-letting by leeches, especially when simple convulsions resist treatment and in those due to uremia. If the convulsions be unduly prolonged, the use of morphin hypodermically is both safe and gratifying. If the first dose (of say $\frac{1}{48}$ grain to a six-months-old baby) is not sufficient, a second may be given in an hour, of double the first dose ($\frac{1}{24}$ grain), and again, in an hour, double of this ($\frac{1}{12}$ grain) if needed, or until quiet is secured.

When there is asphyxia or marked cyanosis, oxygen is a valuable agent; this is best administered to infants through a large face-piece and one straight tube. When the bowels are sufficiently cleared, sedatives can be administered by the rectum; chloral and the bromids are most used. For a six-months-old baby four grains of chloral or six grains of bromid of sodium or strontium, one or both, may be given; for a baby of one year six grains of chloral and ten of a bromid is a suitable dose, to be repeated again at hourly intervals if needed. Authorities differ as to whether an emetic should be employed; but if there is reason to believe that there is undigested food in the stomach, this should be used; and while there may be theoretic objections, we have no reason to believe that harm has been thus caused. Emesis in children is so readily induced that there need be little fear of injurious effects unless excessive stimulus is employed by overdosing with emetics. So soon as the child can swallow, it is well to give a grain or two of calomel, which acts usefully in several ways, even if it does not purge. To produce a full laxation, where this seems necessary, milk of magnesia, castor oil, or some other active drug can be employed. After having instituted these measures to overcome the activity of the convulsion, a thorough search should be made for such sources of reflex irritation as phimosis, an approaching tooth, foreign bodies in the nose or ears, etc. As soon as possible the history of the case should be scrutinized for remoter conditions, such as the existence of a pneumonia, the possibility of the beginning of an exanthem, etc. It must be borne in mind that the occurrence of convulsions is much more frequent and vastly more dangerous during the progress than at the beginning of either pneumonias or the exanthemata. If they arise at the end of an exhausting

disease, as of those two just mentioned, or of a prolonged diarrhea, the process is essentially different and will call for other measures. If the urine contains albumin, which must be ascertained without delay, diaphoresis is important; but diuresis must not be neglected, and here repeated injections of warm salt solution through the bowel is of value, or also hypodermatoclysis. Among the acute conditions which are competent to produce convulsions in healthy children are injuries to the head, which are liable to be followed by shock and are to be treated as such by external heat, cold to the head, and stimulating enemata. Sunstroke and heat exhaustion call for appropriate treatment; in the former, external cold is indicated, and, in the latter, heat and stimulants, of which among the best is coffee. An accidental cause may be mechanical obstruction of the upper air-passages, and, if apnea is the chief difficulty, the introduction of a tongue depressor, drawing the tongue firmly down and forward, may remove the symptom almost immediately. Lastly, it must not be forgotten that convulsions may be a phenomenon of impending death, when it is impossible to expect to relieve them; although it is oftentimes admissible to make use of strychnin hypodermically and in large doses, and of other forms of stimulation.

TABLE OF CAUSES OF INFANTILE CONVULSIONS.—(*From T. M. Rotch.*)

Central.	*Peripheral (Reflex).*
1. Diseases of high temperature (isolation, meningitis, the exanthemata, pneumonia, and others).	Rachitis.
2. Diseases accompanied by vascular stasis (pertussis, cardiac diseases, tumors, hydrocephalus).	Food.
3. Diseases characterized by anemia and exhaustion (loss of blood, diarrhea).	Intestinal parasites.
4. Various toxic causes, such as drugs or uremia (belladonna, nephritis).	Dental irritation.
5. Organic central lesions (cerebral paralysis or any other lesions of the brain).	Foreign bodies in the ear and nose.
6. Presumably organic disturbance of the brain (epilepsy).	Hot baths.
	Mental disturbances, such as fright, and numerous other causes.

TETANY.

Tetany is a motor neurosis called by some authorities a disease, but is more generally described as a mere disorder based upon several pathologic factors which are more or less constant. It is probably of toxic origin, and bears close etiologic relationship to rickets, being based upon similar causative factors and sharing some of the symptom phases of that disease. It is far from common, yet can not be considered rare, and is much more frequently recognized of late years, since its entity is better known and clearly described. Tetany is manifested by charac-

teristic attitudes of the hands and certain intermittent tonic cramps of the muscles of the arms and legs, by an excessive electric irritability, and by periods of latency during which the cramps can be artificially induced.

Causes.—Tetany arises in certain localities, and is not seen again for long periods. It may become epidemic (Bruns). The condition was described by Trousseau originally, who discovered the important symptom known by his name—viz., that an attack could be induced in an affected subject by compressing the arteries and the nerve trunks. Tetany occurs in both adults and children in about equal frequency (B. Sachs), but most cases are seen in the very young. Holt says it is usually seen in early infancy. Barthez and Sanné found it more often in children and most in infants. Griffith found 66 per cent. under two years of age.

The disorder is much more common among the children of the lower classes, and those whose surroundings are unwholesome. It almost always follows upon depressing conditions, overexertion, or recognizable disorders or diseases, especially the transmissible ones; hence its pathology is regarded as a toxemia of probably a complex sort, or perhaps a mere neurosis. It is frequently associated with rickets. Rarely it has resulted from a known poison, such as lead, alcohol, or ergot. It occurs as a finality to, or is associated with, structural diseases of the nerves, and is known to result from extirpation of the thyroid gland. That the thyroid gland secretes a something, the absence or excess of which is followed by a perturbation of the normal nervous balance, is a fascinating view, of which Ewald makes a strong point. Weiss pointed out the connection between these toxins and tetany. That intestinal parasites secrete a peculiarly disturbing toxin is urged by Albu and others. Maestro advocates the administration of extract of thyroid gland, and exhibits clinical findings from the measure which are convincing; and in this S. S. Adams follows him confidently. Tetany was at one time regarded as an occupation neurosis, but Kussmaul corrected this view. Any exhausting disease is a possible cause of tetany in those predisposed to this form of motor disturbance. The connection of the disease with rickets is still a topic for discussion.

The **etiology** of tetany in childhood is not clear. It never affects healthy children. Rachitis is of important predisposing influence. The direct cause of the attack is some gastro-intestinal disturbance, proved by the frequent association of tetany and acute dyspepsia, and the effect of treatment directed to such conditions (Hauser).

Symptoms.—The symptoms of tetany are to be divided into those of the attack and those of the period of latency. The onset of the paroxysms may be preceded by sensory phenomena, but is often sudden and without warning. The sensations are usually vague tingling pains in the forearms and legs, followed soon by a tonic spasm or a stiffness in the muscles. This spasm is most marked in the upper extremities, giving rise to such a pronounced rigidity that it is almost impossible to overcome the resistance by active effort on the part of another. Occasionally the adductors of the thighs and arms are involved, causing the arms and legs to be drawn together; more rarely the muscles of the neck are involved, and also those of the face and trunk. Morse says the only true pathognomonic symptom is spontaneous intermittent paroxysmal muscular contractions. The most common seat of these contractures is in the muscles of the forearms, the fingers being flexed at the metacarpophalangeal joints, while the phalanges are extended, the thumbs being strongly adducted, the wrists acutely flexed, and the hands turned to the ulnar side. The position of the hand is called the "accoucher's hand" or the "writing hand." Other attitudes are, however, occasionally seen, such as a firm clutching or even complete extension of the fingers. The forearm may be flexed upon the arm, the arm adducted to the shoulder.

If the lower extremities are involved, the thighs may be adducted, the legs extended or flexed; the toes are apt to assume the position of talipes equinus. The spasms may affect the muscles of the abdomen, the back, the diaphragm, and the thoracic muscles; hence inspiration is endangered and cyanosis may result, even consciousness being lost (Weiss). Trismus is rare, yet opisthotonos is not exceptional. Other muscles may be affected, as of the eyes, the esophagus, the pharynx, the larynx, or even the bladder. Laryngeal spasm is a common accompaniment of the disorder. Naturally, this degree of overtonicity may cause muscular pains. The degree of spasm varies, and also its length. It may last from two minutes to two hours or more. As has been said, the involvement of the muscles is symmetric. Cases have been reported of one side only, or unilateral for a time. In the contracted muscles fibrillary twitchings have occurred; clonic movements almost never. Tremor is common. The spasm begins in the periphery, not from within outward, as in tetanus; nor are the masseters early affected, as in that more serious malady; nor is reflex excitability high; nor is the spasm continuous as in tetanus.

During the intervals the patient is comparatively comfortable. The muscles are often tender and sore, and they are weakened. The intervals are variable: usually a few hours, or it may be several days or weeks. Other symptoms are those of Trousseau, already mentioned. This is the phenomenon—that if, during the passive interval, the limb be grasped in such a way that the great nerves or arteries which lie along the under surface of the limbs are pressed upon forcibly, the characteristic cramp can be made to return. It may require some continuance of this pressure to elicit the phenomenon, but when it is present, it is regarded as pathognomonic of tetany. This is not always to be obtained: in perhaps only one-fourth of all cases. Its value is great in demonstrating the existence of "latent tetany," a form in which there is at no time a clearly marked contracture. Chvostek's sign is rare in children. It consists in an extraordinary susceptibility of the nerves in tetany to mechanical impressions. For example, a blow with a percussion hammer over the facial nerve produces a twitching of the angle of the mouth or of all the muscles of the facial distribution.

The third important sign of tetany, known as Erb's sign, is a greatly exaggerated electric excitability of the nerves. Weak faradic or galvanic currents produce muscular contractions in excess of the normal response. Cathodal closure contractions are found with small currents, but also with moderate currents; also cathodal closure tetanus and anodal opening tetanus, which are not observed in any other condition.

The most convenient test, and one which usually suffices in an affected person, is the increased mechanical excitability, a simple touch, a light pressure on nerve, being enough to produce contractions in the muscles supplied by it. It is less painful to the subject than to induce an attack by pressure on a large trunk or artery (B. Sachs).

Sensory phenomena are few; there are no disturbances of cutaneous sensibility. Headache, vertigo, nystagmus, and tinnitus aurium are described as coexisting. Temperature elevation is only rarely produced, but may be present because of some underlying condition.

Respiration is not, as a rule, affected. Dyspnea is sometimes produced by fixation of the muscles of the thorax and the diaphragm. The pulse is often increased in frequency. The urine is rarely affected; it may be increased in amount. Nephritis occurs occasionally. There are seen, at times, certain nutritive disturbances affecting the hair, nails, etc. The reflexes do not show any characteristic alterations, and are, as a rule, normal.

The duration of an attack of tetany is most variable. There may be many remissions of greater or less severity, of shorter or longer periods of abeyance.

Diagnosis.—The clinical picture of tetany is thoroughly characteristic, and should be easily recognized.

The position of the hands, the fingers grouped together or held rigidly in this or some other attitude, as in extension, the legs which are oftentimes affected as well, or both arms and legs firmly adducted, should instantly excite suspicion. On investigation the sign of Trousseau would reveal the condition, even during the periods of latency; that of Chvostek (irritability to slight mechanical stimuli) and that of Erb (electric excitability, as described) should make the diagnosis clear. Morse regards the one symptom pathognomonic of tetany: the spontaneous intermittent paroxysmal contractions of the muscles of the forearms.

Not all the characteristic symptoms are seen in each case, and the absence of some one or other does not vitiate the diagnosis.

Pathologic Anatomy.—No constant nor characteristic lesion has been found present at autopsies in tetany. Serous exudation into the cervical cord and into the ventricles of the brain, sclerotic changes, spinal extradural hemorrhage, atrophy in the ganglion cells and nerve-fibers, and proliferation of the neuroglia are among the conditions found, as enumerated by Dercum.

The subject has been variously viewed by those who have made researches in this line (Langhans, Weiss, Gowers, Schlesinger, and others), and little other than speculations are offered. The facts are scanty as yet, and it is better to content ourselves for the present with the view that tetany is due to the effects of a toxin or toxins upon the entire nervous system in one so predisposed.

Romme, reviewing the claims of various authors as to the etiology of tetany, concludes that the views of Kassowitz and his school (that it is a manifestation of rickets) and those of others who would ascribe the condition to any especial primary disease are incorrect, as there are no constant postmortem findings in tetany, and it occurs in connection with various diseases.

Clinical and pathologic studies tell us only that the main symptoms are evidences of mechanical or reflex hyperexcitability of the cord and peripheral nerves due to a diversity of causes.

In an analytic study of 6822 children, with special attention to determining the nature of tetany and its relationship to rickets

and laryngeal spasm, Cassel* found 60 cases of tetany. The nutrition was good in 14, moderately good in 13, poor in 23, and bad in 10. All presented spontaneous intermittent spasm, which could be induced by pressure upon the large nerves and vessels of the affected parts. In all but 3 the facial phenomenon was present. Only 2 had laryngeal spasm, and both of these presented craniotabes in addition to other symptoms of rickets. Without exception the children were nervous and slept badly. Fourteen presented a rise of temperature; in 9 the disorder was the result of complicating conditions and in the remainder it arose without apparent cause. In 21 cases digestive disturbance preceded or accompanied the tetany; in 5 there was chronic dyspepsia, in 43 digestive disorder, in 6 obstinate constipation, and in 4 habitual vomiting. Rickets was present in 52 of the 60 cases; in only 8 there was no trace of rickets. Tetany was seen throughout the entire year, although the largest number appeared to occur in the spring and late autumn. There was no suggestion of an epidemic occurrence of the disease, nor was there any relation as to frequency between tetany, rickets, laryngeal spasm, and craniotabes. Cassel concludes that tetany is neither a complication of rickets nor of digestive disturbance, but is dependent upon unfavorable conditions of living, improper nutrition, and bad air.

The evidences point to the conclusion that tetany is a disorder of the nerves, somewhat generally distributed, and of toxic origin. It arises, almost always, in those who have suffered from exhausting conditions, depressing circumstances, or acute diseases, or all three.

Prognosis.—The prognosis of tetany, on the whole, is favorable. Most cases recover. Sievers notes two fatal cases which occurred in connection with dilatation of the stomach. In both there were stenosis of the pylorus from healed ulcers and enormous dilatation.

In all the reports of fatal cases of tetany, twenty-seven in number, there was usually found dilatation, due to stenosis from scars of pyloric or duodenal ulcers, or ulcer and scar without stenosis. Those cases which follow upon extirpation of the thyroid gland are usually fatal.

Treatment.—If rickets be accepted as the essential cause, it is plain we must determine what has produced that disease; and the findings of the foremost clinicians yet are limited here, also, to much the same factors as give origin to tetany. The disorder is

* "Deut. med. Woch.," Jan. 28, 1897.

one chiefly of excess of motion; and prodigality of motion—as we have constantly maintained, in dealing with disorders of motion, such as chorea—is always followed by exhaustion (fatigue neurosis); hence the fundamental need for all such states is absolute rest for both body and mind. The next indication is to remove all sources of peripheral irritation. The mass of evidence is in favor of gastro-intestinal irritation being the chief factor; hence the digestive organs will need fullest attention. As toxins are admitted to be the chief source of disturbance in tetany, eliminants are also in order. A few well-directed doses of calomel will meet many indications. Beyond this, and a regulation of diet, it is seldom needful to go. If the spasmodic phenomena are excessive or painful, it is well to proceed in the same lines as in dealing with convulsions. The inhalation of chloroform, or a mixture of chloroform, nitrite of amyl, and ether (parts 3, 1, and 5), will hold the spasm in check. Sedatives, such as the bromids, chloral, and hyoscin hydrobromate may then be used, or, possibly, morphin hypodermically. Finally, nutritive tonics will be required in most cases, and to be maintained for a long time. (See Convulsions.)

AUTOMATIC MOVEMENTS.

Automatic movements may occur in the following diseases: (1) Anomalous epilepsy. (2) Hysteria of childhood, exhibiting general, quasipurposeful movements; also hysteric, salaam, and hysteric eclampsia rotans. (3) Athetosis (athetoid movements in asthenic conditions). (4) Automatic rhythmic movements. These are better displayed in a table:

- Automatic rhythmic movements
  - Head nodding and shaking.
    - Movement of assent.
    - Negative movements.
  - Gyrospasm.
  - Head banging.
  - Eclampsia nutans or salaam convulsions.
  - Eclampsia rotans.

(5) Tic convulsif. (6) Induced automatic movements.

It may be advantageous to examine each division carefully and endeavor to define diagnostic features and differences, and in a few instances it is possible to assign a cause.

Anomalous Epilepsies.—In this form there is exhibited a most marked display of automatic imperative movements. By relating a typical case a good concept can be formed: A boy, aged seventeen, weakly, nervous, and irritable. The attack

begins usually with a sharp cry and without further development. The patient commences to run aimlessly through the street, usually at a good speed. If stopped by any one, he may struggle violently, or even pass into epileptic convulsions, from which he awakens exhausted, asks for water, and promptly goes to sleep. His apparent oblivion to the external world, the inability to make any impression by speaking to him, his avoidance of collision with objects and people, and particularly his absence of remembrance, when he awakes, of events taking place during the attack, lead one to regard it a pure case of secondary consciousness of automatic and, usually, centric origin.

Some patients run round and round, only stopping to fall exhausted and senseless to the floor. Another variety manifests no motor excitation whatever; the patient will suddenly, in the midst of some rational action, wander quietly off by himself, accost persons on the street, and at times threaten to do violence if the one addressed does not agree to some absurd demand on his part. Then comes the awakening. The patient does not know where he is or how he got there, and exhibits signs of exhaustion and thirst.

The *treatment* of these cases is the same as that for idiopathic epilepsy.

Hysteria of Childhood.—In referring here to hysteria, we shall simply consider that type in which there are observed automatic movements.

Hysteria of childhood is a condition which frequently simulates anomalous epilepsy, and at times it is only with extreme difficulty that a differentiation can be made. Like epilepsy, there is often an initial scream, which differs in quality from that of epilepsy, and which usually is not given until the patient (usually a female) is aware that she has an audience. The patient then falls to the ground in a way that she may not be hurt. At times a very fair representation of opisthotonos is presented. Engorgement of veins about the head is frequently noted, and more or less active tonic spasm is present. After this follows a condition of relaxation, with wild quasipurposeful movements of the arms; broken short sentences, explosions of passion and profanity, weeping, laughing, and grinding of the teeth follow. The larger and more sympathetic the audience, the more varied and emotional will be the manifestations.

Anesthesia, paralyses, hallucinations, and ecstasies are exhibited in their turn, and gradually the patient quiets down to normal. The notable feature in these cases is the imperative and purposeful

movements, mostly confined to the arms, which the patient will often assert, during the attacks, she can not possibly stop.

Athetosis should never be confused with any other automatic condition, and all that need be said of it here is that when hysteric, or secondary to some functional or mild disorder, good prognosis may be given; otherwise it should be guarded.

Automatic Rhythmic Movements. — In this term are broadly included head nodding, or movements of assent; head shaking, or negation movements (synonymous with spasmus nutans and nictitatio spatia); gyrospasm; head banging; eclampsia nutans, or salaam convulsions; and eclampsia rotans.

Head nodding and head shaking are manifestations which appear in the infant at any time between the ages of two and eighteen months. They are sometimes preceded by injury to the head, as might be occasioned by a slight fall. But the condition has appeared so many times when such history can not be elicited that it would lead one to think an injury is not an essential factor in the etiology. In most cases the nodding and shaking are preceded a week or ten days by nystagmus, which may be vertical or horizontal, or vertical in one eye and horizontal in the other. At times there is only a uniocular nystagmus. When the nodding and shaking appear, they are usually limited to a few attacks a day, which tend to increase in number. There sometimes appear cases in which there is almost constant nutans of a mild type, with strong exacerbations. In the great majority of cases the movements seem to be accentuated when the attention is distracted, or if the child makes an effort to hold his head still. Caille reports cases where movements ceased when attention was fixed and also if eyes were bandaged. His treatment of the case was to keep the eyes bandaged for some weeks—only removing the dressing to flush out the conjunctiva. Recovery ensued. The pupils are usually dilated, the eye-grounds normal. The few cases in which fundus changes have been found are coincidental. Occasionally there occur periods of unconsciousness, with marked deviation of eyes to right or left (Hadden).

Very frequently there is a history of rickets, and the rosary and other features are well marked. In most of Hadden's cases there occurred, as early symptoms, the throwing back of the head and looking at objects with partially closed eyes.

Head nodding is much rarer than head shaking. Occasionally these alternate in the same patient.

If it be desirable at this time, with our limited knowledge of the condition, to classify them under any particular heading, hysteria in childhood would seem to present the greatest claim, for in

hysteria there are frequently salaam movements, pure and simple. Until more is known of the essential nature of those conditions and their relation to the few different lesions which have been found in the brain at death, it will be an impossibility for us to go further than to offer surmises as regards a classification. They are so frequently associated with defective mental development that the suspicion of their being significant of some deep-seated developmental error is urgent.

When a combination of motor impulses by their cross-action imparts a rotary motion to the head, this is known as gyrospasm (Peterson). These spasmodic conditions sometimes increase during sleep. According to Peterson, the number of excursions of the head in these affections rarely exceeds two or three a second. The child may only have an attack during the night, or it may be so persistent that it suddenly awakens him every time he composes himself for sleep.

The following is a case of gyrospasm of our own hitherto unreported: B. S., aged six months, female, Russian Hebrew, of excellent family history,—mother a large, vigorous woman with abundant breast milk,—was brought to Polyclinic Dispensary for relief of gyrospasm. One older child, perfectly strong, was also breast fed. This infant was regarded as exceptionally vigorous, had never been ill, held up its head at three months, and had no convulsions. Automatic movements began ten days ago without ascertainable cause. The first movement was forward and back nodding, alternating with a slight rotary action, noticed from time to time during the morning only. On the second day movement was more marked and constant, the series consisting of two or three nods, followed by fifteen or twenty rapid rotations, then a quiet interval. In all there were perhaps twenty paroxysms during the day; these are now continuous, and do not altogether cease during sleep.

On examination the infant seems perfectly normal in other respects; is cheerful and intelligent, of good color, and well nourished. On endeavor to make the child fix its eyes or converge them the movements cease for a few seconds, and are replaced by lateral nystagmus, but soon the gyrospasm recurs with increased force. Lowering the eyes, the head leaning forward, also brings relief. The case recovered entirely in a short time.

In eclampsia nutans and rotans there is a bowing, or salaaming, movement of the neck. Hadden differentiates those conditions from head nodding and head banging, and calls eclampsia nutans and rotans a variety of epilepsy.

In anomalous or aberrant forms of epilepsy there is a salaaming, but also there are other signs of epilepsy.

A perfectly analogous condition to all the above automatic imperative movements may be induced by suggestion under hypnotism.

Other motor neuroses—such as habit chorea, habit spasm, convulsive tics, echolalia, coprolalia—are dealt with elsewhere.

Treatment.—The treatment of head movements is change of air and climate, and nutritious food and out-of-door life, as much as possible; in short, improved hygiene, careful search being made for and correction of any source of reflex irritation, such as postnasal adenoids, adherent prepuce, phimosis, dentitional disturbances, intestinal disorders, intestinal parasites, etc.

Most of the sufferers are too young to warrant the correction of errors of refraction, though they may readily exert an influence. The condition of any of the aforesaid irritations may solve the difficulty. It is safe, nevertheless, to begin at once on a treatment by sedatives,—bromides, valerian, chloral, etc.,—nutritive tonics, such as cod-liver oil, iron, phosphorus; fatty and albuminous foods, and the organic nucleo-albumins are likewise indicated. H. C. Wood likens these conditions to those of chorea, which is due, in his opinion, to depression of the inhibitory centers governing the anterior cornual cells of the cord. He accordingly recommends quinin as an inhibitory stimulant.

EPILEPSY.

Epilepsy—the falling sickness, *morbus sacer* of the ancients—is a syndrome or a collection of symptoms rather than a disease. It is one of the hereditary diseases or disorders of the nervous system, characterized by paroxysms of unconsciousness, associated with or occasionally without convulsions.

The causes of epileptic seizures are of infinite variety. In the majority of cases epilepsy begins before puberty, and rarely after the twenty-fifth year. Heredity plays an important rôle: 35 per cent. of Gowers' cases were due to heredity. Families in whom neuralgia, hysteria, insanity, or any other neurosis prevails are most liable to fall victims to this malady. Any cause which impairs the general health and exhausts the nervous system acts as a predisposing influence. Chronic alcoholism, syphilitic taints (in parents), trauma existing from childhood, infectious diseases of childhood, reflex irritations, intestinal worms, disordered dentition, adherent prepuce, foreign body in nose or ear, and

errors in ocular refraction have been claimed by eminent clinicians as predisposing factors.

Epileptoid disorders are now becoming more carefully differentiated and grouped into such classes as can be shown to have a common cause: for example, hysteria, which imitates so closely many diseases, puerperal convulsions or eclampsia, uremic convulsions and other toxemias, the common convulsive prodromes of the infectious diseases, and certain degenerative processes.

The name epilepsy is given to a large group of convulsive disorders, the causes of which are unknown, though they may be shrewdly suspected by reason of facts which are progressively less easy to interpret. When a local area of the brain cortex is disordered sufficiently to produce irregular discharges, it is called "focal epilepsy." These cases may be explained by a focus of inflammation, a new growth, or an injury to the skull.

In a smaller group of epilepsies the cause can not be differentiated, and these are still misdescribed by the term idiopathic. It is generally admitted (certainly this is our conviction) that a predisposition to convulsive states is required for most causes to act upon, and this is especially true for reflex causes.

Instability of nervous equilibrium will render one child vulnerable to slight motor influences, whereas another, similarly or even worse exposed, may escape convulsions.

Causes.—The causes of epilepsy are various. Focal epilepsy is recognized to be due to a demonstrable lesion, injury, or new growth. The idiopathic forms are explainable upon some conditions of degeneration, the results of hereditary or congenital states, and not capable of graphic postmortem demonstration.

Alcoholism in the parents is potent to induce the degenerative processes, or further to impair nervous stability and increase an existing susceptibility. It is our conviction that when all things are considered, alcohol is an agent responsible for a much larger number of instances of degeneration than any other single agent.

Morbid Anatomy.—Gross deformities, such as absence of a part of the brain (porencephalia) or areas of changed consistency (sclerosis, softening, or the like), are to be classed under proper heads. These contribute to the production of mental impairment or destruction. In chronic epilepsies there have been found areas of sclerosis,—especially in the horn of Ammon (Feré),—neurogliar sclerosis (Chaslin), a real gliosis or proliferation of the neuroglia.

Symptoms.—The one most conspicuous factor in epilepsy is the convulsion, an explosion of nervous discharge from the brain

centers. The convulsion is apparently dependent upon cellular instability of the motor centers. Trivial irritation of these centers causes the epileptic fits. This is accompanied by a loss of consciousness and various physical disorders. The more important feature by far is the psychic disturbances.

The most graphic feature of epilepsy is the fit. This is commonly subdivided into two distinct varieties—major attacks, or *grand mal*, and minor attacks, or *petit mal*. It is only too common to find those who suffer from both varieties. While there is, even in the same individual, a sliding scale between these two varieties, yet there are very distinct differences, especially in the line of prognosis, the lesser attacks being much more difficult to control. During the interval there is little or nothing to distinguish the sufferer from a well person. The disorder consists of an ever-present tendency for the victim to suffer from a fit or convulsion, brief or protracted, accompanied by psychoses of the gravest importance. In most cases—and they are the fortunate ones—there is a distinct warning, more or less definite and extensive. Those who possess this are enabled to seek a place of safety before the attack overmasters them; they are also enabled to use remedies which are sometimes successful in warding off the worst. These prodromes are sometimes vague sensations referred to the stomach, or curious sensations, as formication in the extremities. At times these consist of slight twitching movements or mental or emotional states, restlessness, irritability of temper, or excitement. Sometimes the vision is affected or other sensory auræ exist. The chief symptoms of an attack of major epilepsy are thus arranged by Sachs, in their order of importance and their usual occurrence:

1. Prodromes, generally of a sensory character. At times there is a vasomotor or psychic disturbance.
2. Initial cry.
3. Loss of consciousness (very sudden).
4. Pupils dilated; no reaction.
5. Tonic or clonic spasm of muscles (unilateral, partial, or general).
6. Spasm of respiratory muscles, which may lead to asphyxia.
7. Spasm of the muscles of the jaw (biting of the tongue, bloody foam).
8. Spasm relaxes and movements become clonic and then intermittent.
9. Involuntary passage of urine or of feces.
10. Gradual recovery of consciousness, followed by a prolonged stupor or profound sleep.

In a disorder which offers so many possibilities for accidental extraneous damage it is most valuable for the sufferer to obtain adequate warning. In a reasonable proportion of cases this is furnished, usually by certain sensory phenomena, or it may be slight movements; others may evidence excitement, irritability, or aphasia; the kind of aura may act as a key to the form of seizure, or point to the cause. When the aura is clear and rightly interpreted by the patient, an invaluable opportunity is afforded to seek a place of safety or otherwise prepare for the oncoming period of unconsciousness.

Partial or unilateral epilepsy points toward foci of organic mischief. In this form of epilepsy, spoken of as Jacksonian, there is usually undisturbed consciousness. General convulsions rather indicate hereditary or idiopathic forms. The localized convulsions may at any time become general, and then there is practically no ground for differentiation. It is wise to search carefully into the history of every case for hereditary or parental causes, and into the personal history of possible trauma during birth, and the exact form of attack as indicating possible organic brain trouble. All this will potently influence both prognosis and treatment.

In a certain number of instances the attack is almost altogether motor and occurs during sleep. This is called by Lloyd "somnaic epilepsy," a better term than "nocturnal," as it is during sleep the attack occurs be this by day or night.

Masked epilepsy is that variety in which the sensory and motor features are replaced by psychoses, often mere vagaries, but sometimes maniacal outbreaks. These cases are often most obscure and require close study and emphatic warning to parents and caretakers.

By far the most important symptoms of epilepsy are the psychic phenomena. "Epilepsy is much more than a fit: its essential factor is a wide-spread, degenerative process which involves not only the sensory and motor cortex, but also the highest intellectual centers of the brain" (Lloyd).

In certain cases disordered mental states accompany the aura: confusion, fear, or anger arises, which passes into the convulsion or stupor.

Episodes of maniacal fury may replace the ordinary features of the paroxysm, or pass into other forms of mental derangement, as of confusional states, delusions, or moral perversions. Masked epilepsy or moral mania may follow the paroxysm, hence we have preepileptic and postepileptic states of a most important and dangerous character, and belonging as an essential factor to it.

Many of the large viscera are affected, impairing function and jeopardizing life. Digestion is frequently disordered, especially after the fit, as well as loss of control over sphincters and transient albuminuria. Gastro-intestinal disorders also precipitate the fit, and the removal of these changes both the severity and character of the disease.

When the disorder has begun in early life, various stigmata of degeneration are often seen, such as asymmetries of cranium and face, stunted growth, poor teeth, and low-type ears and genitalia.

Diagnosis.—In epilepsy the aura, suddenness of the attack, and loss of consciousness, accompanied by tonic and clonic spasms, are distinctive features. If these are repeated at more or less regular intervals, the diagnosis is conclusive. Exaggerated deep reflexes in one half of the body indicate a preceding hemiplegia as the cause.

Hysteria simulates epilepsy, but there are obvious points of difference in the history, degree of unconsciousness, etc. Uremia induces fits very like the disorder, but is to be recognized by the history and urinalysis. Organic brain-lesions induce convulsions closely resembling epilepsy. In these cases are also paralyses of motion and sensation, optic neuritis, vomiting, acute mental symptoms, headaches, and the special history.

Reflex epilepsy in children from gastro-intestinal disorders occurs in those who are strongly predisposed to convulsive states or already damaged by infectious diseases.

Possibly a cure can be effected here before the condition progresses too far.

Prognosis.—A cure is possible in a few favorable cases not dependent on gross brain changes. In chronic cases, from whatever cause, little hope can be held out, although no effort must be spared to strive to control the convulsions, which in their progress work mischief, and it is always possible that a good result may be achieved.

Surgery affords increasing possibilities year by year. We have seen one case get entirely well, although morbid impulses remained. The outlook is, however, far from brilliant.

Treatment.—The treatment of epilepsy should always embrace two considerations: One directed to the prevention of the attack, and the other to the control of the nervous discharges or overaction of the cortical cells. As has been shown, grave instability of the nervous cells in an individual renders him extremely susceptible to potent irritants of all sorts, psychic and physical. Every means should be employed to maintain the

patient on an even plane, in a wholesome equilibrium. All circumstances calculated to produce gross disturbances should be avoided. Overcrowding, close atmosphere, extreme excitement, digestive disturbances, are in themselves capable of precipitating an attack. A sufferer from epilepsy should live a life of great regularity, provided with suitable amusement, occupation, and education, and be kept as much as possible in the open air. The organs of digestion should receive especial and unremitting care. A single indiscretion may bring on a fit, neglect of bowel evacuation, and, above all, if intestinal putrefaction takes place, this may not only induce an attack, but actually be the starting-point of the disease in one so predisposed. The skin should receive adequate attention and cool bathing; sea-baths and sometimes hot or medicated baths and oil inunctions are valuable auxiliary measures. Sleep should be undisturbed and sound. Tranquilizing medicines had better be given increasingly toward night. Above all, there should be secured moral and mental tranquillity and contentment. By such means as these alone the seizures may be markedly lessened in severity and oftentimes in numbers. Many reflex sources of irritation have been accredited with the power of producing the disease, such as eye-strain, disordered ocular muscle balance, refractive errors, and the like, adenoid growths, laryngeal irritation, adherent prepuces, intestinal parasites. Indeed, the whole train of reflex irritations are more or less efficient as well as instrumental causes, which should always be removed or sedulously controlled.

Of drugs, the bromids have held first place in spite of all rivals. They are not curative, strictly speaking, but through their use some cases have recovered. At least, the use of bromids, especially if judiciously administered, with proper regulation and safeguards, mitigate most admirably the severity and number of the attacks, not seldom keeping them off successfully, and enabling the patient to be a useful citizen. The action of the bromids is generally held to be chiefly that of motor depressants, checking the overexcitability of the cortical cells. There is evidence to show that they exert another quality by lessening the activity of the toxins circulating in the blood, which at or near a convulsive seizure are distinctly more virulent. Of the form of bromid, the salt of potassium is most widely used, but that of sodium is even better, and of lithium better still; ammonium bromid may be used; a mixture of several bromids is claimed to be of exceptional value, and it is usually best to use them in combination. Much has been claimed for the bromid of strontium, which exerts far less disturbance on the stomach,

skin, and mentality, and is the best for children. The best menstruum for the bromids is an essence or elixir of pepsin. It is also well to give, along with these, both arsenic and iron, not only for their action in overcoming the depreciating effects of the bromids upon the blood, but for their own tonic properties. The doses of the bromids should be adjusted to secure a definite effect, increasing or lessening them as they exert a recognizable influence over the fit. There is also another rule useful to remember, and that is to give the doses increasingly toward night, with the largest dose at bedtime, both because the patient is better for thoroughly sound sleep and also to mitigate the disagreeable effects which the drug may exert throughout the waking hours. Children bear the bromids well. Other drugs are useful for their tranquilizing properties, and are often added with value to the bromids—namely, antipyrin, iodid of potassium, belladonna, especially, and also chloral hydrate, acetanilid, and a host of others. Along with a bromid powdered charcoal in essence of pepsin or pancreatin is useful when accompanied by fermentative dyspepsias. To replace the bromids for a shorter or longer period sulphonal serves a good purpose, and trional also, and occasionally the opiates or codein with great caution. Changes in drugs must frequently be made, and most cases improve surprisingly with every change for a time. Flechsig has emphasized the value of a bromo-opiate combination, using the opiate in the solid form in increasing doses for six weeks; then abruptly replacing this by bromids. Cases of long-standing epilepsy not otherwise relieved are thus sometimes much benefited.

Drugs which have the effect of lessening connective tissue or neurogliar proliferation exert a peculiar influence, among which are the iodids, various preparations of mercury and arsenic, nitrate of silver, and zinc.

Certain remedies deserve mention in connection with special forms of epilepsy. Inhalations of amyl nitrite, suggested by Weir Mitchell, are of greatest utility where there is an aura, recognizable by the patient in time to make use of it. This is well combined with chloroform, and is especially useful in the status epilepticus.

When the heart is at fault, lacking tone or rhythm, etc., cardiac tonics, such as digitalis, are of value alone or along with other drugs. If the vascular tension is too high, this is relieved by the nitrites. Belladonna is a useful adjuvant too—hyoscin hydrobromate or coniin hydrobromate when a change in the form of motor depression is needed. Almost any new

plan of treatment is followed by improvement for a time. The best results are had from healthy, tranquil outdoor life, with limited dietary and rigid attention to the emunctories.

CHOREA.

Synonyms.—SYDENHAM'S CHOREA; CHOREA MINOR; ST. VITUS' DANCE.

Chorea is a functional nervous disease of childhood and early adolescence, characterized by sudden, rapid, irregular, and involuntary twitching of some or all of the muscles of the body, and by a deficient control of the muscles affected.

The movements produced are unexpected and can not be accurately imitated nor voluntarily checked for any length of time. Attention or excitement may increase them; so, indeed, does the effort to restrain. This difference may mark the type or alternate more or less.

In milder forms the twitchings are brief, but in a few instances the movements are so large and violent as to imperil life or limb, and by the constancy of passive muscular acts tend to exhaust the sufferer most profoundly. This exhaustion must not be overlooked in treatment and plays a part in all cases.

Two classes of movements are recognized: In the one these lessen notably on voluntary movement in coordinate acts (passive chorea), and in the other they greatly increase, often rendering the result of attempted effort impossible (intention chorea). The disorder is more apparent in the extremities, most commonly in the hands and muscles of the face and tongue, producing grimaces, especially while talking. The lower limbs are also much disturbed, rendering locomotion peculiar, producing a characteristic awkwardness, and oftentimes an uneasy fidgeting about the body and shoulders. One of the commonest forms is for the arms to jerk suddenly back while making an effort to reach for an object, and in another the face muscles are distorted, causing a most imbecile appearance, with which chagrin at failure to maintain control has much to do.

The endeavor to stand still controls the movements for a few seconds, to be followed by greater intensity of the disordered action. Chorea may be of one side only (hemichorea), in about one-third of cases (Starr), and recurrences are liable to arise in the same limited way. In two-thirds of cases the ataxia affects both sides, or in a few instances it is bilateral, but greater on one than on the other side.

In rarer cases there is but slight movement and marked muscle

paresis. Speech is often disordered (dysarthria), due to choreic action of the muscles used in articulation and also in respiration. The rare instances of laryngeal chorea cause sounds to be emitted like the yelping of a dog, but these should not be confounded with hysteric barking.

The mental disturbances described by some writers as occurring in chorea are much more likely to be due, as Sachs points out, to exhaustion; and the irregularity of temper is a natural sequence of the long and exasperating agitation of both body and mind.

A frequent complication of chorea is rheumatism, by many ascribed as a cause in about one-fourth of cases; the most serious complication is disease of the heart, which may be and usually is due to the same factor. Rheumatism in a child is not readily recognized by temperature and swellings, but must be searched for among the more obscure symptoms, as fleeting pains ("growing pains") and joints becoming tender upon pressure.

Causes.—Chorea is a neurosis of childhood and youth, occurring from birth to late old age, but oftenest at or about the thirteenth year, the majority of cases between five and fifteen. Hereditary predisposition is a marked factor, as well as descent from choreic parents and also those who are sufferers from epilepsy and migraine and other neuroses.

Females are three times more subject to chorea than males. Season exerts a marked influence, by far the largest number arising in the spring (May to July; next, December to February, according to Morris Lewis, Weir Mitchell, and Starr), but Putnam and Gowers do not confirm this view.

Anemia and the bad hygiene which causes it are at the foundation of many cases, and are commonly found associated with the disorder.

The direct causes of St. Vitus' dance are fright, overwork, such as study, rheumatism, and the acute infectious diseases. Fright is the most powerful for harm, and many instances are recorded in which this seems the only accountable reason. In at least one-third of the cases it has been shown to be the exciting cause. Various peripheral reflex causes are pointed out as etiologic factors, especially gastro-intestinal disturbances, ocular defects, nasopharyngeal growths, etc.

There is a similarity in the causal factors of both chorea and rheumatism, and these may produce the one or the other. Neurotic heredity is an important factor. Heart disease also often precedes the neurosis. We have had well-marked cases of endocarditis in which chorea subsequently developed during or late in the attack.

The relation of chorea and epilepsy is most interesting and warrants further study.

Symptoms.—Chorea comes on gradually, as a rule, by slight irregularities of purposeless movement and increasing steadily or suddenly. The child drops objects and is considered awkward, may trip and stumble, and make strange faces. Fully developed chorea is unmistakable and obvious. Movements usually cease in sleep.

The heart in all cases should be repeatedly and most carefully watched. Mitral regurgitant murmurs are commonest. Aortic disease is rare. True, these do sometimes entirely pass away, and it is impossible to be sure of organic disease existing or persisting, especially as anemia is a frequent accompaniment of the disorder as well as a slight dilatation of the heart. It is possible that some of these murmurs may be due to chorea of the heart muscles. The urine is frequently loaded with uric acid—an indication of profound disturbance of nutrition. Subcutaneous nodules, occasionally seen, have a probable origin in rheumatic states.

The whole clinical picture in chorea is of an irritable, miserable child, not ill, but wretched and enfeebled, of poor appetite and sleep, exhausted, often apathetic, and at times suffering pain from headaches, etc. The average duration of chorea is put at about ten weeks, and recurrences are frequent at short or long intervals—often two or three, and as many as eight, times (Sachs). Weir Mitchell teaches that during spring and fall these sufferers should be kept under observation for preventive treatment before the usual times for recurrence.

The relapses vary greatly, from a few weeks to as many years, usually of medium type, but not always. They may recur in similar form, but often presenting quite a different character of movements.

In certain recent studies of choreiform movements by Weir Mitchell and J. H. W. Rhein the conclusions are as follows:

1. There are cases which show, some at one stage, some throughout their course, absence of movement during rest. The movements, mild or severe, are developed only during muscular acts.

2. Others in whom continued movement is greatly increased during intentional effort.

3. In certain cases the movement disappears during intentional muscular acts.

4. Others again appear unaltered by voluntary muscular acts.

5. In a few cases the various types alternate or shift.

A tremor exists in some cases of chorea, replacing in part the ordinary movements, or this may coexist with them.

In some few cases the movement is rhythmic and vibratory, resembling a large tremor.

The **diagnosis** is usually easy enough. The character of the movements is so clearly marked as to serve all through medical phraseology as a descriptive term, such as "choreic" or "choreiform." Sachs calls attention to the "facies" of chorea, of which the chief point is the peculiar attitude of the protruded tongue.

Weir Mitchell long ago called attention to a variety of incoordinate movements following cerebral paresis or descending atrophies, to which he gave the name of "postparalytic chorea."

Writers have variously discussed this pro and con., but some of the best observers admit that the resemblance of these mobile spasms to true chorea is so close that differential diagnosis, aside from a history of cerebral origin, is almost impossible. The points for contrast are the reflexes (increased in cerebral trouble), contractures, rigidity, etc., not found in uncomplicated functional chorea. When chorea is persistent, it is often possible to find evidences of cerebral lesion. This form of chorea is not so common (6 per cent. of cases) as athetosis in the cerebral conditions.

Pathology.—No end of structural lesions of the brain have been accused of giving origin to chorea, but the discrepancy of these various opinions is so marked that their value is *nil.* Most of the changes described are secondary to various precedent conditions, and in the younger cases, as a rule, but also in children old enough to have had various lesions.

The changes observed are mostly cortical, and there is usually some change in the gray matter of the central nervous system. The tendency is to regard chorea as due to primary vascular changes which may be dependent upon infectious processes. The true pathology of chorea is unknown as yet. Barbour maintains that in chorea there is an altered state of nutrition of the motor cells of the cerebrospinal axis, by reason of which they lose in part their capacity for storing nerve force, and discharge themselves prematurely: Money encountered capillary emboli in the optic thalamus; Flechsig found hyaline changes in the two anterior divisions of the lenticular nucleus; Dana found an intense cerebral and spinal hyperemia, dilatation of the vessels, small hemorrhages, spots of softening, and an infiltration of the perivascular spaces with round cells; Carrod suggests the possibility that chorea is due to an overgrowth of connective tissue in the

nerve centers; Golgi found calcification of the Purkinjé cells of the cerebellum; and Elischer saw hyaline degeneration in the nerve-cells of the central ganglia. We can not say with any degree of assurance what is really the cause of this disease. As so many observers have found different changes in different localities of the central nervous system, it may be taken for granted that the changes mentioned above are accidental, individual changes which have little or nothing to do with the clinical symptoms of chorea.

Treatment.—Whatever view we may take of the origin of chorea, it is probable that each case has more than one factor in its causation, along with varying individual susceptibility, nervous stability, age, and season. Chorea is, in its manifestation and course, a motor excitability producing exhaustion; and while usually terminating in full recovery, soon or late, nevertheless a certain number suffer recurrences and a few are marked for life. If the rheumatic element appears prominently, as it does in one-third of all cases, exceptional care and imperativeness must be exercised to eradicate it. Watchfulness is needed lest it should suddenly appear and produce serious heart-lesion; hence a greater caution is demanded than is generally enforced. Moreover, to obtain prompt as well as complete results, one may best be overparticular and thorough in outlining and enforcing measures for relief. These range themselves under five heads:

1. *Specific medication*, directed to recognizable conditions, as rheumatism, malaria, or other infectious cause, and the empiric use of arsenic, the one remedy which uniformly yields good results.

2. *Rest* to the body, which is in extreme overaction, whence a reaction falls upon the motor centers, interfering with sleep, etc.

3. *Nutritional repair*, necessitated by the many factors which unite in depreciating and devitalizing the tissues, plus the wear and tear from exaggerated muscular action.

4. *Reeducation of coordination*, a very important but little noticed item.

5. *To prevent recurrence* by anticipating the periodic return and enforcing suitable measures. Cases should return in spring and fall, September and February especially, to be put upon arsenic in ascending doses.

It is assumed that we desire to get the quickest and best results.

First, then, whenever possible, it is well to put the child to bed for a time, making use of adequate clothing to prevent exposure and permitting play with toys (not books) after a few

days. The food should be of the plainest for a fortnight at least, and altogether omitting red meats. Nitrogenous compounds are ever unstable; these should be left out in all explosive conditions, and also to secure tranquilization of the excessive nervous discharges. Sweets should be permitted only in moderation, using a diet mostly of milk, fruits, and vegetables. The child should be bathed freely in tepid water twice a day, better than once, getting it cooler and cooler. It is well to flush the spinal areas with cold water from the first, after the warm application has been made, and use sharp friction to the whole skin surface. If this is done with the dry-salt towel, a better surface glow is secured. A laxative every second or third day for the first week may be needed, to make sure of freedom from intestinal irritation or fecal toxins.

Children suffering from chorea are usually pallid and often found to be anemic and flabby. The excessive restlessness uses up both nervous energy and blood, hence arise unconscious fatigue and wasteful metabolism. For this the carbohydrates offer better supply than albuminoids, and our custom is to enforce the use of fats. Cod-liver oil was first used for rheumatic conditions and still stands preeminent as a recuperative agent in disorders of this nature. It is best given in capsule and often only once or twice a day. Iron is not often needed, especially when arsenic is employed for its specific action—whatever that may be. For the first fortnight, bathing twice daily, with vigorous salt towelings, is enough of tonic to the surface. After that employ massage to redistribute blood from depths to surface and also for its controlling power over nervous disquietude. For this effect it should be administered somewhat differently from the usual methods: slow, steady surface-stroking should be followed by firm, quiet kneading, ending with passive movements of the limbs and overstretching, like that used for spastic conditions. In children a shorter seance is required—not more than half an hour.

As soon as the prodigality of movements comes under control, greater liberty may be allowed both in diet and exercise. Then to be partly dressed and remain up and about the room for most of the day, resuming ordinary occupations, is admissible, not permitting any fatigue production, however, and, above all, no excitement or annoyance.

When the ataxia has been excessive, a most useful measure for restoring clean and accurate coordination is to reeducate the limbs and motor centers by teaching the use of accurate movements at word of command, systematic posings, and mild, free

exercises. It is well to direct the action of the eye up, down, to right and left; the fundamental arm and leg attitudes, rising gradually to complex acts, as tossing and catching a ball or bean-bag. All this in regulated doses, and followed by bathing and rest. In all exercises of convalescents, regulated or free, a period of absolute rest should immediately follow.

Of medicines, not a very large variety warrant confidence. If any trace of rheumatic pain show, it is best met by the salicylates, internally or by inunction, which children bear very well anyhow, or alkalies. (See Rheumatism.) Precede with a laxative, and follow with the arsenic. Nothing is better than Fowler's solution, begun at three drops, thrice daily, increasing one drop a day (which just doubles itself on the tenth day), and continuing until toxic symptoms are manifested. Then stop for one day, and continue the daily dose just preceding the toxic signs for several days. If this proves too much, stop and begin at the three drops, and go up again. When movements have ceased, do not increase, but keep on at the dose of arsenic reached until a week has passed without twitching. In severe cases arsenic may best be given hypodermically; moreover, some will receive it better thus than by the mouth. For this purpose liquor potassii arsenitis may be made without the lavender. Arsenic thus enters the circulation without first passing through the liver, and the poisonous effects are not so readily produced. The arseniate of soda is recommended for this, using a 5 per cent. solution, commencing with three drops, gradually increasing until ten to fifteen drops are taken or toxic symptoms are produced.

In using Fowler's solution always write out the schedule of increments on a card, thus:

First day,	3, 3, 3,
Second day,	3, 3, 4,
Third day,	3, 4, 4,
Fourth day,	4, 4, 4, etc.,

Until about the tenth day. Each day the nurse may check off the figures, showing the exact progress. It is of value to write full directions, indicating possible complications and toxic symptoms.

Quinin has been claimed as a specific upon the theory of its central action, reinforcing inhibition. It has, not often, but occasionally, done good service at our hands in chorea. The possibility of malaria being at the bottom of the disorder must not be lost sight of, when, of course, we may expect results from its use. Moreover, quinin has a most happy effect upon spasmodic action, as in pertussis. In severe cases, when these

measures fail, Cheadle has recommended the hypodermic use of hyoscin hydrobromate twice a day, in doses of from $\frac{1}{500}$ to $\frac{1}{200}$ of a grain.

And, finally, chorea may pass into a habit spasm, although that mimetic disorder arises in other ways. Habit chorea, however it may come, is a close relative to the real thing, and is benefited by much the same treatment. Nevertheless, it is often a most intractable condition and requires firm moral means to check it. Hypnotism, powerful suggestion, and mild fright are all useful. Suggestion helps sensible children by assuring them they can become rid of a foolish and entirely controllable state.

The steam-bath or hot pack, to secure sleep and eliminate toxins, has given admirable results in certain cases, particularly when the disorder has persisted in spite of rational treatment. This employed twice daily for four days, without other than dietetic treatment and laxatives, then followed by specific medicines, has yielded excellent results in our hands.

In cases which have had one or more previous attacks, note the months of onset, and induce them to return one month earlier than the attacks occurred before for treatment. Thus they can be practically aborted.

Habit Movements, Habit Chorea, or Tic.

Among the conspicuous and not rare disturbances of motion are to be mentioned the habit movements, habit spasms, or convulsive tics strongly resembling chorea, but with special features of their own, and marked differences as to nature, causation, and curability.

These are tricks of movements, coordination of muscular acts, generally involving the face, shoulders, and sometimes legs, simulating purposes, accompanied occasionally by speech or vocal and other sounds. In the majority of cases they began as imitations or repetitions of acts, becoming fixed and exaggerated into habits, which are difficult to cure in proportion as they are matured, and occasionally persist throughout life.

Probably the commonest starting-point is chorea minor, especially where the attention of the child has been drawn to some particular movement or act in another, and conscious or unconscious repetitions have been indulged in and then changed to another variety until a series is formed, which performance is repeated in succession. Any such trick should be promptly recognized by parents and unqualifiedly condemned, nipping them in the bud ere they become an offense.

It is well to use a systematic nomenclature in dealing with this class of allied affections, which Osler says pass insensibly into one another "from a simple, habitual, conscious spasm of the facial muscles to complete coordinate movements with marked physical features, or to habit phenomena purely psychic." The distinguishing factor in the entire group is the habit of repetition, whether of motion or idea, which, while influenced or controlled to some extent by the will, occurs in response to a sort of impulsion in the case of muscular movements, and in the case of imperative ideas as a sort of obsession.

1. Habit spasms, or simple tic, are the common instances of spasmodic movements, chiefly of the face muscles and moderately under volitional control. The acts are repeated more positively and with far greater rapidity than those of chorea; they are more systematic, purposive, and limited in scope. There are cases of sudden contraction of certain muscles very like that produced by an electric shock; hence Henoch has called this electric chorea.

2. Convulsive tic, or Gilles de la Tourette's disease, exhibits, in addition to the ordinary motor disturbances of habit spasm, imperative ideas and explosive, jerky shouts and ejaculations. Some of the words thus unintentionally uttered or flung out of the mouth are accidental reflections of what has been casually heard and yet received a degree of subconscious attention, either with a partly formed intention to use again, or as probably a full intention never to utter: as, for instance, obscene phrases, of which the patient may be unconscious or through the use of which he becomes intensely mortified.

3. Complex Coordinated Tics (Noir from "Bourneville's Clinic").—There are tricks of this kind mentioned by many, several of them being strung together in a series: as, a child when offered an object always blows upon it, smells it, and turns half away, or stooping down, lying on the floor, raising the hands above the head, etc.

4. Psychic tic, or imperative ideas, the outgrowth from imperative movements, the fixed idea impelling a child to do certain things under similar circumstances, as the old trick of stepping on different paving-stones without touching the cracks, always to go out of the way in passing certain objects, to cross the street at a certain place each time in passing, etc. So strong are these as to make the life of the sufferer a burden by the multiplicity of the meaningless procedures.

The **treatment** of these disorders is largely suggestive. Oftentimes hygienic measures are required, and many of the

rational means outlined under the treatment of chorea will prove of value. Outside domination is generally required to aid the sufferer to rid himself of the disorder. Partial hypnosis is most effective, prophetic statements as to when and how the recovery will recur (always indulged in with due caution to reinforce probability), and dominant commands at times often suffice. In spite of well-directed measures many cases persist until death.

HEREDITARY OR HUNTINGDON'S CHOREA is a very rare malady, seldom appearing in children, but due to conditions chiefly hereditary, which arise from causes affecting the child in earliest developmental epochs. Several members of the same family are usually affected. The symptoms generally grow worse as age advances. The movements of hereditary chorea are "coarse and grimacing, and may be distributed over a large area of the body." They are partly controlled by volition (passive). In true chorea the movements are more localized. Huntingdon's chorea may be confounded with posthemiplegic chorea or hemispasm. The reflexes, however, are not markedly altered; in the cerebral disorders they are exaggerated. Hysteria may simulate this, but exhibits other and characteristic phenomena.

Hereditary chorea is incurable; life is not materially shortened, but there is a strong tendency toward dementia in its victims. Treatment is the same as for true chorea, and the severity of the symptoms can be much mitigated by rational measures.

POSTPARALYTIC OR POSTHEMIPLEGIC CHOREA is a choreiform disorder strongly resembling chorea at times, but due to changes in the motor areas of the brain and described under Cerebral Palsies.

INSANITY AND DISTURBANCES OF THE MIND IN CHILDREN.

The subject of mental disorders occurring in children can only be treated, in a book of this size, in a general and comprehensive way. Systematic classification is of little avail, and this will be found in special works on the subject.

Mental disorders in children must of necessity be of a simple kind, since the intellectual faculties are in them not yet highly specialized. True insanity in children has been occasionally observed in the very young; even the more conspicuous kinds, as raving madness, have been noticed. It is important to bear in mind that these mental disturbances of children, while at times well defined, with sufficiently definite symptoms to warrant both

classification and definite prognosis, nevertheless change very much from time to time, and that which threatened to be serious may subside most surprisingly; furthermore, the varieties may overlap considerably, rendering a clear-cut diagnosis difficult or impossible. The prognosis in most cases is to be very guarded and is usually good, provided the most favorable circumstances can be secured, with wholesome environment and wise care.

The most important subjects for the pediatrist to study are the developmental neuroses, arising, as the name implies, during periods of growth, and their later variegated forms, resembling one or another of the recognized forms of insanity and hysteria.* Some of these pass readily away as growth proceeds; others become confirmed or change into serious mental states.

We will give a brief review of the different forms of insanity occurring in children, as outlined by Mills:

Transitory Psychoses.—Under this head will be considered delirium arising from special causes, some children being more susceptible than others to mental perturbations due to slight rises of temperature. Some children again have highly developed imaginations, and these, excited by parents and others, produce temporary disturbances of mind which are grave sources of peril and readily productive of permanent states.

Night-terrors (pavor nocturnus) is a form of temporary mental disturbance. This transitory psychosis usually takes the form of excited or agitated melancholia, giving evidence of great mental suffering and depression, vague and indescribable. Day-terrors is also recognized, differing little in clinical features.

Mania is the form of insanity most frequently occurring in childhood. It appears in the form of an active delirium, with great motor excitability, emotional expansions and hallucinations, and at times delusions in children old enough to have imaginative ideas. Mania may be recovered from or become permanent.

Melancholia seldom begins before five or six years of age. It usually merges into the monomanias and other disturbed mental states. The varieties seen in children are simple melancholias, the excited or agitated, and the hypochondriacal. Depressing surroundings and deprivations sometimes drive children to suicide.

Circular or **alternating insanity** is a form in which there is, first, exaltation or mania, followed by mental depression and then lucid periods, and later exaltation, again to be followed by brief melancholy, the cycle coming and going with variations.

* An article on developmental neuroses was omitted for lack of space.

Choreic insanity is a form of mental disturbance following upon chorea, which is a variety so severe as to exhaust the patient, interfering with sleep and health. It is sometimes of a very violent character, with great emotional exaltation.

Hysteric Insanity.—In childhood acute mania and hysteric mania run together into a picture most difficult to differentiate. If the characteristic symptoms of hysteria are present,—ecstasy, catalepsy, trance, aphonia, and fantastic emotions or false palsies, —there will be little difficulty in distinguishing between hysteric conditions and insanity. Extraordinary occurrences which have given rise to the suspicion of visitation by spirits, by rappings, cat-calls, rooms being set on fire, and such like things are very likely to be the result of this form of disorder among children, especially girls. Frequently there arise in institutions and schools imitative psychoses, occurring in epidemics; there are then ordinarily found among the symptoms disturbances of speech, hallucinations of sight and sound, and false palsies.

Cataleptic insanity, or **catatonia,** is very rare among children. This form begins usually as a mania, followed by melancholy, with stupor, and instances of dramatic exhibitions following.

Epileptic insanity is not rare in children of well-marked imbecile or idiotic characteristics, and who are the victims of epilepsy. Sometimes attacks of insanity or mania occur among children who suffer from epilepsy, and who in the interval between the attacks are apparently sound in mind. The mania may occur just before or after the epileptic paroxysm, or replace it. It should not be a source of surprise if epileptic children occasionally show marked perversion of character and manner.

Paranoia, or **primary delusional insanity,** is a chronic form of mental disease, or, in certain instances, mere mental instability accompanied by insistent ideas, exaggerated self-consciousness and perversity of character, and morbid impulse. Paranoia is rare under the age of puberty, but to the trained observer certain marked peculiarities and eccentricities will lead him to predict the development later, in such defectives, of delusional insanity. The symptoms are gross peculiarities in dress and conversation, obtrusive ideas and egoisms, tendencies to dreaming states, and a bustling attempt at remarkable plans leading to nothing, unduly emphasized concepts or misconcepts, with alternate periods of depression and emotional excitement.

Moral insanity and **moral imbecility** are terms which are needed to describe those vicious habits and tendencies constantly showing themselves in certain children who are otherwise appar-

ently wholesome minded. Instinctive perversions and morbid impulses flow out of some inherited constitutional conditions which are at the root of monomania and paranoia. To estimate rightly such states as these it is necessary to understand fully such words as "concepts," which may be morbid or imperative; also "imperative movements," "insistent ideas," or unhealthy propensities. The concept is a definite or isolated thought, which may become an impression and tyrannize the mind; imperative movement or action is an unhealthy impulse, the result of an imperative conception. The term "insistent idea" is used to describe a habit of thought resulting from the repetition and multiplication of morbid conceptions, which may, after a time, interfere with and dominate the acts of volition and intellect.

Morbid fears, or **phobias,** are conditions occurring on the borderland between mental health and disease, which may be transient or more or less permanent, and generally have to do with hereditary impressions. These may occur in a mild form and persist throughout a moderately useful life.

Paretic dementia is essentially a disease of adult life, but in rare instances is seen in children.

IMBECILITY, FEEBLE-MINDEDNESS, AND IDIOCY.

It is important to mention also the subject of idiocy and imbecility in a work of this character, to enable the general practitioner, who usually takes small pains to investigate the subject, to recognize the condition and early to put the patient in the position to secure relief, repair, or at least mitigation. It must not be assumed that, because these conditions, as usually seen, are practically incurable, they need little or no attention except at the hands of specialists. Incalculable relief can be afforded to many of the victims of the higher grades of imbecility if they receive judicious care in their earliest formative periods. This is important for many reasons, chiefly for the families of such, who will suffer far less misery and discomfort if they are put on their guard and learn how to manage the sufferers in the right way. They should learn to know the limitations and not to expect too much, nor to inflict punishment upon backward children for faults due solely to their inability to form wholesome mental concepts of duties and responsibilities. The imbecile, moreover, exhibits well-marked characteristics, a proper appreciation of which will enable the parents to educate him to become an endurable member of the family or of the community. Perhaps the most important consideration is the question of marriage and reproduc-

tion, to prevent which every effort should be made and authority exercised. It is of the utmost insistence that children of obvious mental defects, even of a relatively mild character, should be removed from their homes and placed in the keeping and under the guidance of those who are competent to assume this responsibility. The machinery of an ordinary household is altogether unfitted to bear the additional burden of these strange and uncertain factors.

The reason for this bears equally upon the component members of the household, on the one hand, and the defective child, on the other, who is certain to be made worse by the overfond solicitude of a parent or the impatience or harshness which is more likely to govern the actions of those who must assume the grievous burden, not knowing how it should be borne nor how the poor creature should be managed.

By the term idiocy is meant a congenital absence of mentality and intellection. By the term imbecility is simply meant an arrested or partial development.

A child's mind may normally develop until it reaches the age of six years. Let us now suppose that the child ceases to develop mentally and intellectually. At thirty years of age we would have a creature whose mentality was six years old.

Again, imbecility does not of necessity indicate arrest of development. A partial arrest of development will cause an imbecile.

Imbecility, feeble-mindedness, and mere backwardness are terms used to denote the lesser degrees of mental deficiency, which run through a very wide, varying scale. Mere slowness to acquire knowledge is of far less importance than disabilities of judgment or lack of balance in the reasoning faculties necessary in the ordinary affairs of life. Where, as frequently happens, there is conjoined to manifest mental discrepancies yet fairly large capacities in certain lines, the difficulties of estimation are even greater. This produces a state which the world at large is loath to regard as unfit for responsibility, and yet none the less requires the exercise of safeguards and control. The inferiority of such an individual is rarely detected in the family circle, but once the child is thrown into competition with others in the outer world, its peculiarities become more or less conspicuous. Under these circumstances the feeble-witted person becomes either the butt or the tolerated one, is treated as a creature apart, and fails to grow in mind and character. The imbecile can not appreciate the reason for his lack of success, and is incapable of developing the higher moral ideas or faculties, and it is from these defectives

that the mischief-makers and criminals develop, and those in whom the ideas of right and wrong have never been clearly conceived or differentiated. The idiot is a much simpler problem than the imbecile. Being little better than an animal, with merely gross resemblances to a human being, there can be no question that he is unfit to be retained in the family circle, where he absolutely has no place, despite all the well-intentioned sentiment or affection which may desire it. The idiot is a person who lacks capacity to form the ordinary mental concepts or judgments, and whose brain is incapable of receiving and interpreting impressions from the outer world.

The **symptoms** of the various kinds of mental defects in children would occupy too large a space to enumerate thoroughly. A complete idiot is a human being not only bereft of intellectual qualities, but without even the intelligence as ordinarily seen in animals. These symptoms run through a very considerable scale, from helpless, speechless idiocy up to a type of being called " imbecile." An imbecile is a human being possessed of the ordinary intellectual faculties, but of a very low order. This definition is obviously lacking in definiteness, but it is scarcely possible to be exact. Beyond the imbecile class we reckon feeble-minded and backward children, which brings us up to a type merged imperceptibly into the average members of society. The symptoms of the idiot are altogether apparent: there are usually a general restlessness of movement and awkwardness, a ready excitability and irritability of temper, and peculiarity of facial expression. The question of diagnosis is usually whether the mental deficiency is reparable, capable of mitigation or cure, or hopeless. Among imbeciles of the higher grades much can be accomplished by careful educational measures and firm, gentle control.

Myxedematous idiots and cretins, though extremely rare in America, are interesting, chiefly because of the possibilities of cure which have been opened up in recent years by the one specific agency about which many startling claims are made—namely, feeding with thyroid extract. The pulverized gland is now used extensively, and with some brilliant results upon both the mind and body. The dose is from ½ of a grain to a grain, three times a day, for children two years old, up to two or three or even five grains for older children. This sometimes produces untoward effects, which are so obvious and varied that it is scarcely worth while to discuss them here.

Treatment of Insanity and Mental Disorders of Childhood.—In order to prevent mental enfeeblement in the young

we must first defend them from degenerating influences of a kind competent to leave a permanent impression upon the individual or the offspring. Next, opportunity must be afforded for development of both body and mind, which are interdependent. Again, protection must be afforded against accidental injury by trauma or poisons.

It is rare to meet a mother capable of rightly training a child not altogether wise. Some, happily, are admirably gifted in this respect, and if the mother is capable of being, or will submit herself to be, carefully instructed how such a case shall be managed, sometimes the very best results come from home care. It has been our experience to see some excellent instances of these mothers, and we are inclined to believe that this possibility may be amplified by educating willing mothers to this duty. Again, we have found immediate relatives who both could and would undertake this care and bring about excellent results. As a rule, the mother is so hampered by emotional considerations that her judgment is not good in respect to her own child. Then the question arises, To whom shall it be committed? It has been our custom, and we think from it some excellent results have come, to always search about among the home possibilities of such a case, and not seldom there has been found some good maiden woman or widowed aunt or childless person who could be taught to do what the same child's own mother might be able to do for some other woman's child. We have before us always the admirable example of the insane colonies of Europe, where excellent results come from treatment in private houses, and whenever this can be accomplished, it is better to do so.

In questioning, examining, or otherwise dealing with the child as a neurotic patient, success in arriving at right conclusions depends as much on the demeanor and conduct of the physician as on his knowledge. With the adult this may possibly not be true, but in respect to the less differentiated mental organization of the child the proposition will hold. Skill born of much experience is needed to win the confidence of the child, and to this must be added tact and gentleness. Here, again, gentleness should not lack firmness and decision. If the patient is one whose disposition or morals are obviously disordered, it is of double importance to approach the problem aright, either to learn essential facts or to select remedies.

Medicines are usually quite needless, but moral control and tactful domination must be ever forthcoming. The physician should succeed in impressing his personality upon the patient. He must represent embodied power, helpfulness, and justice.

LANE MEDICAL LIBRARY
STANFORD UNIVERSITY
MEDICAL CENTER
STANFORD, CALIF. 94305

In some instances he may be of a loving manner, pleading with the obstinate but sensitive, errant nature. More often he needs to pose as a kindly yet overmastering being, to whom confession and obedience must be yielded soon or late. Again, over-voluble, highly graphic confessions of the patient are to be discounted. Always obedience must be exacted, but tempered by due consideration of immediate necessities and no more. Gradually simple but systematic measures may be given shape and pushed steadily to an end.

Much tactful shifting in the position of the questioner is often demanded, and seemingly unessential procedures are at times advisable; patience, persistence, and firmness always.

The heedless examiner will often give to the shrewd observation of the hysteric or insane child leading points on which to fashion its symptom-groups by his idle words and leakage of thought while "thinking aloud," and he may be thus misled afar. Moreover, the distinction between these closely resembling conditions is not seldom a purely relative matter, to be decided by the personal factor of the observer or the social or individual standard of the patient.

Again, hysteria and organic brain diseases may coexist, not often in the child, it is true, but will prove most puzzling.

Moral perversions are hard to distinguish from merely evil and vicious tendencies, which are acquired by a stupid, impressionable subject.

The moral imbecile is inherently bad and practically incurable. He is an instinctive liar and thief, cunning and skilful in mischief-making, and if in other ways seemingly competent, yet unspeakably provoking to the teacher or parent. To know how to deal best with such is generally conditional upon a clear decision as to whether one has to do with an ineradicable vice or disease (here probably synonymous) or a possibly removable disorder. The main thing is not to attempt for the individual too elaborate a plan of improvement, and when he is under favorable surroundings to exercise infinite patience and use abundant time. He is to be made to know that while not fully trusted or believed, the utmost encouragement shall be enjoyed so soon as evidence of improvement is shown.

Along with obviously wicked acts may often coexist evidences of disease processes, as convulsions. It is often most difficult to determine surely whether these are epileptic or hysteric. These may appear in combination, too—hysteric attacks in an epileptic subject, a blending to which there is no clear key.

Typical, clear-cut cases of neurotic maladies are none too

common, and ordinarily it is only by the after-fruits of treatment that they are determined. A large familiarity with hysteric states increases one's respect for the difficulties of differentiation.

Hysteria must have some sort of audience always, and wherever vanity can be detected or surmised, it will help to determine the nature of the attack. The instinct of the physician is also an aid, but must not be masked by prejudice.

In the management and moral training of children of hysteric or maniacal tendencies the first step to be gained by physician or caretaker is to win their confidence. The best method to pursue is to show and preserve a frank, quiet, yet persistently friendly demeanor. In first interviews it is wise with all children to avoid a too direct and impulsive approach. Childish concepts come slowly; conclusions which are being formed with no great promptitude should not be hurried. Overprecipitancy offends, and the result is negative. Very much the same courteous, straightforward methods win a child which prevail with the elder.

It is well to efface, as nearly as possible, the differences of age and position between the patient and physician. Assume both to be on the same plane, the one simply taking the initiative. It is inscrutable to us how those people who talk baby-talk (as it is ludicrously miscalled) to children ever succeed in rendering themselves otherwise than most offensive.

Knowledge of the mental processes of the patient one must have, and accurate information only comes through intelligent questioning. We have repeatedly been able to secure the attention and frank answers of a child, which our assistants had utterly failed to get, by conveying the impression that we were just such a person as themselves, who asked straightforward questions and fully intended to obtain equally candid replies. And if this be true of the medical man in rare interviews, how much more needful it is that those who watch and direct the daily progress of the child shall proceed in the same frank, honest fashion ever.

Punishment is sometimes needed: sharp, corporeal punishment, too. Some children of low tone or vicious hysteroid character are amenable to no other argument. Who shall administer this, and when, is of gravest importance to determine, and only harm comes of lack of judgment here. Oftener gentle domination or kindly encouragement will suffice. A jocose, bantering tone also offends. Begin by questioning the attendant, parent, or nurse, thus allowing the child to take bearings and see that you are not an oger; then proceed to draw out the childish thoughts gently by speaking on perfectly comprehensive

subjects first, and on others indirectly, and finally directly questioning.

The children of pauper and criminal classes need most careful watching and unusual training in the fundamental principles of morality. Instead of this they usually get overmuch liberty and far too much religious teaching. The training in religious thought and observances has a tendency to foster an exaggerated emotion, which is in some ways closely allied to mental and sexual excitement. Moral instruction should always precede the religious. Moral insanity can only be treated in special institutions.

Many instances of juvenile insanity, particularly of the type of dementias, respond admirably to the use of thyroid extract. In the melancholias it has proved of use, too. It is worth an empirical trial often, even though there be no clear indication for its use, and the physician is watchful of its effects.

HYSTERIA IN CHILDHOOD AND YOUTH.

The tendency during late years has been to make the diagnosis of hysteria much less rashly than of old. The time was, and quite recently, when a large number of puzzling functional affections were called hysteria and treated as such. Increasing knowledge of the disorder is correcting this unfortunate mistake. True hysteria frequently occurs among children, in whom it is sometimes seen in a very graphic form, in boys as well as in girls, although twice as frequently in the latter It increases steadily in frequency of occurrence from the third to the thirteenth year, and no age is exempt. The popular idea of this affection is that it is a mere feigning of disease, though hysteria, while simulating many disorders, is never a true imitation of any. It is a psychosis with clearly defined stigmata, physical and psychic. Hysteria may be described, then, as a functional disturbance of the nervous system due to no known structural lesion, manifested by paralyses, convulsions, psychic and sensory disturbances, and impairment of vision. The early recognition of all the neuroses of childhood is peculiarly important. This is especially true of hysteria, which, if unchecked, seriously modifies character growth and psychic development, as well as obscuring the sequelæ of acute diseases.

In almost no other disorder do we see the influence of remote causes so admirably illustrated as in the hysteria of children. A neurotic ancestry of howsoever wide a variety may be manifested in the child in this form. It is rare, if not impossible, for

children to be thus affected unless there is evidence of neuropathic ancestry, along with debilitating conditions or emotional strain. It readily happens, too, that a powerful example may produce a hysteric outbreak in an apparently well-balanced child. The influence of environment is a most potent factor in the production of hysteria. Exciting causes are exhausting conditions, depressed health from acute diseases, injuries, abusive treatment at the hands of others, overwrought emotionality, and objectionable education generally, especially in religious matters. A very important study for the general practitioner is to search closely into the hereditary and other causes of all the neuroses in children, and it is also a very essential part of his duty. Whenever there is recognized ancestral alcoholism, insanity, or "marked peculiarities," the children must be doubly watched and guarded.

Hysteric symptoms are frequently seen during convalescence from infectious and other acute diseases. Imitative paralysis, contracture, tremor, and persistent local pain or tenderness are likely to follow various injuries, even very trifling ones. Vexations, disappointments, fright, shame, and, above all, religious excitement, are often potent factors in the production of psychic disturbances. An early encouragement of religious thoughts and training, especially of a kind which cultivates emotional exaltation, is powerful for harm in this direction. Perhaps the very worst influence of all, because more constantly present, is unwise, especially careless, home influences, lacking in systematic and watchful control, encouraging selfishness and minor deceptions deemed necessary by the child to secure what is coveted. Lax regulation as to duty and the higher moral faculties is the atmosphere most congenial to the growth of hysteria and even worse things. However, it must not be inferred that hysteria is solely the outcome of individual blameworthiness, nor is it always the result of lax moral conditions; for, on the other hand, puritanic severity is capable of working a large measure of harm. Disorders of the generative organs, especially those resulting from masturbation, are important causative agents about which much might be said, especially as parents are singularly unwilling or unable to control habits of the kind mentioned.

By far the most important element in hysteria is the mental phenomena, which are exceedingly varied and complex, and, to a trained observer, capable of clear differentiation, and yet, when superficially studied, appear a mere mass of mental disturbances, imitative procedures, pretense, and deception. It must first be recognized that hysteria is not a simple feature of degeneracy, but a condition which may be acquired by children of unim-

peachable parentage and otherwise excellent health. The child subject to hysteria is markedly impressionable, with a great tendency to accept and act upon suggestion. There is a dissociation of the higher mental faculties, as of volition and cerebration, from lower emotional and impulsive states. The actions of a hysteric child during the paroxysm result from morbid concepts of associations of ideas, which permit the organic activities to exhibit characteristic irregularities. The key-note to the whole situation is suggestion, both in the production of the psychosis and the emancipation of the sufferer. Morbid suggestion from without or within, one or the other, or both, produces the malady and encourages its continuance; and wise, forceful suggestion from without will effect a cure, especially if accompanied by well-chosen auxiliary measures systematically applied.

The paroxysm of hysteria consists of certain definite steps or procedures which continue from prodromal states with regular gradations to a systematic culmination, or they may be checked here or there, producing even more extraordinary features.

The paroxysm or hysteric fit has acquired the reputation of being the most important manifestation of the disorder, because it is the most conspicuous. It may, however, be absent or only rarely observed, or, again, but atypically exhibited.

The hysteric paroxysm usually begins with certain antecedent features, mostly changes in the mental state, a shifting of the mind from its normal plane. There is never absolute unconsciousness. The exciting cause may or may not be apparent; if not, the point of departure of the fit may be some auto-suggestion.

The fit follows close upon an aura, which may be either sensory or motor. It may begin abruptly, or be preceded by alternate laughing or crying. It usually begins with a subjective feeling, as of a lump rising in the throat, which is accompanied by a sense of suffocation. Another form of aura consists of loud noises, throbbing or beating sounds in the ears; still another is violent headache, a boring or piercing pain, as of a nail being driven into the head (clavus hystericus). At other times there is dimness of vision or alarming dizziness. Again, there may be sensations connected with the ovaries or testicles. The fit proper is usually divided into periods. The first or convulsive period resembles epilepsy, but is in no sense identical with it. The patient sinks down or falls prone upon the back, with the limbs extended and rigid, but with the fingers and toes flexed; the eyes are usually rolled slowly from right to left, or crossed; the jaws are firmly closed; the breathing becomes slow and

labored, and later hurried, the face flushed or bluish, the neck turgid; the cardiac action becomes more rapid and forcible, and consciousness is blunted or even almost, but never entirely, lost. Sensation is much obtunded, and abolished in some portions of the body. Soon clonic movements succeed—a tremor affecting the muscles of the trunk, extremities, and face. This alternates with electric-like startings, during which the patient may fling himself furiously about or actually out of bed. Presently this stage ends with sighs, and is followed by a short sleep.

The next stage is one of dramatic movements, not so commonly seen here as in Europe. These may appear by themselves, and explain some otherwise puzzling conditions. The most common form is a complete opisthotonos, tonic spasm of the muscles of the back, a bowing of the lumbar curve until the child rests only upon head and heels. This may alternate with, or be replaced by, a variety of quaint attitudes and movements, some of which simulate purposive acts; others are merely automatic. The final or closing period of the convulsive attack is one of delirium. This is usually an expression of the dominating mental attitude, and likely to be reproduced in each succeeding fit. It usually expresses some condition of fear or sadness, manifested by tears and sobs and more or less incoherent appealings or pleadings. The attack is not always complete: one period may be exaggerated and the others left out. Especially in children, certain acts may be habitually performed, or changed by suggestion until the combinations are most extraordinary.

A series of apparently purposive movements or merely automatic acts may originate in one individual, and be so powerfully suggestive to others that they unconsciously imitate them, and thus a wide-spread contagion occurs in religious communities and schools, such as gave rise to the dancing manias of the Middle Ages. Somnambulism should be mentioned as having points of contact with the hysteric state. A lethargy also sometimes follows the paroxysm. Catalepsy, another psychosis strongly resembling hysteria, may be observed during or after the hysteric fit. The duration of a paroxysm may be but a few minutes, and then, with intervals of rest, be succeeded by others, as many as two hundred attacks having occurred within twenty-four hours in a case recorded by Sachs; or it may last longer, as in a case observed by the authors, in which the attack continued for the greater part of two hours. Those which occur fragmentarily, or present considerable variety in their manifestations, may continue, with almost no intermission, day in and day out, as in the

epidemic which occurred in the Church Home of this city while one of the authors was on duty there.

The hysteric paroxysm, as has been said, is not the most important symptom of hysteria. The permanent markings (stigmata) of hysteria have to do with changes in sensation, motility, the activities of the viscera, the mind, and nutrition. Alterations in sensibility are nearly always present. Hyperesthesia and local tendernesses are common, as in the well-known hysterogenous zones. These zones and areas of exalted sensation, over which, if pressure is made, pain is produced, and some one or other of the more graphic motor manifestations are elicited; the most common of these are over the ovaries and spine. In boys the testicles are sometimes hypersensitive. Pressure over these zones may give rise to a convulsion, or, again, may cause them to stop. A hysteric pain caused by an old injury may act as a hysterogenous zone, especially in one of the joints, as the hip or knee.

Disturbances or alterations of sensation are characteristic of hysteria. Anesthesia, more or less complete, is nearly always present in the hysteric subject, who may often be ignorant of its presence. Sometimes this is only of one side of the body, divided with great exactness in the middle line from head to heel (hemianesthesia); and sometimes occurs in irregularly distributed areas (disseminated anesthesia); or, again, is distinctly localized in one arm or one leg (segmental anesthesia). This last may be accompanied by motor impairment (palsy) of the part. The areas of anesthesia, when pricked, do not readily bleed (ischemia). The organs of special sense are often disturbed in hemianesthesia, and always upon the affected side. Of these the most important are the eyes; there may be a concentric narrowing of the visual field, or an alteration or reversal in the color-fields (amblyopia or color scotoma). There may be deafness of one side, or impairment of smell or taste. The changes in the color-field, when characteristic, are one of the most certain points for differential diagnosis.

The disturbances of motility in hysteria are either loss of function (paralysis) or perversion of function (contraction and tremor). These symptoms are very apt to appear by themselves. The paralyses of hysteria simulate those due to central nervous disease in their distribution, but not in their clinical history. They may be named in the order of frequency with which they occur in children—viz., paraplegia, monoplegia, and hemiplegia. The paralysis of motion is commonly, but not always, accompanied by paralysis of sensation. The onset is usually sudden,

and in form may be flaccid or spastic. The immediate cause is usually some emotional perturbation, which may be psychic or traumatic. The contractures in hysteria may be either partial or complete, a local stiffening or a spasm. These contractures may persist for years, though not always constant, and sometimes returning upon slight excitation ; they may remain in the same place or pass from one part to another. Tremor is rare in children ; loss of voice is not common, neither is increased rapidity of respiration (tachypnea). Hysteric vomiting, also rare in the young, is a very serious matter when it does occur, imperiling health or even life. Its character is *sui generis* a mere regurgitation, due to a spasm of the esophagus. The intestine is sometimes paralyzed in hysteria, producing an immense bloating, with noisy belching, which is usually concomitant with a condition of emotional excitement.

Hysteria is a psychosis, a profound disorder of functional activities, of almost universal distribution, but due to no known demonstrable lesion. By some change in mechanism an entire half of the brain is temporarily invalided, which alone can explain the complete hemianesthesia. The possibility of transferring this anesthesia from one side to the other would show the two halves of the brain to be in sympathy one with the other. The cortical inhibition is lessened, leaving the lower centers unchecked. Recently expressed opinions upon the mobility of the neuron enable us to reach a clearer understanding of hysteric states, but as yet scarcely explain the accompanying phenomena. The hysteric child evidences a marked vulnerability to certain perturbing influences, is always susceptible to psychic changes and functional disturbance. The manifestations of the disease may disappear during many years and yet readily recur under the influence of slight morbid agencies or changes in condition or emotional irritation.

The **treatment** of hysteria in children or in adults is always complicated by the fact that the causes which produce it have so much to do with environment. It is difficult, almost impossible, to effect a cure unless the unfavorable environment is changed. It is easy to point out how a case may be benefited or cured, but not so easy to enforce the measures with sufficient thoroughness to produce a satisfactory result.

Bosnia, in "The Paidologist," April, 1900, says: "Medical science employs three methods in these cases: (1) *The method of startling:* The child is overpowered by a simple and powerful command. (Stand up! Speak loud! Do n't cough!) There is no time left for the child to be ill. (2) *The method of premeditated*

neglect: The doctor does not take any notice of the child, so the child gets tired of self-thoughts and forgets his illness. (3) *The method of disguised psychic means* (hydrotherapy, electricity, mild corporal punishment): This therapy is based on the faith the patient has in the treatment. It is more efficacious in adults than in children. Electricity and cold water benefit children, inasmuch as the processes are more or less painful. They fear a repetition, and this fear is often strong enough to banish the pathologic ideas and the morbid symptoms arising from them."

The most important point in treatment, to be always insisted upon, is a complete separation of the child from its parents or previous caretakers during a considerable period of time. The physician finds himself in a very difficult situation, and will usually be compelled to compromise. Indeed, it may sometimes be wiser to do this, and then gradually lead up to other measures more and more efficient and complete. The first part of the treatment should consist in the systematic application of measures directed to the improvement of general health, which may not seem obviously much impaired. An essential factor in the production of a cure is a properly qualified nurse or, in rare instances, a wise and patient member of the family who can be taught to exercise the necessary control. The next most important element in the treatment is moral training, a complete remodeling of the point of view of duties to self and others.

Bosnia, *op. cit.*, says: "Wrong education is a most powerful factor in the causation of psychogenic troubles, especially in cases where a natural disposition toward them exists. If, through wrong education, moods are not suppressed, good habits not established, training of will-power neglected, and the imagination allowed to run riot, we are in great danger of cultivating the neurasthenic soil on which all sorts of psychogenic affections may grow up."

It is of the greatest importance for physicians to realize that drugs are of no value whatsoever in the treatment of the psychosis known as hysteria. Judicious reasoning, frank conversation of an educational kind, and vigorous suggestions, with sometimes the added pomp and circumstance of the proper place and conditions, are powerful agents for good. Thus, a steady repetition of suggestion, with judicious and thorough detail, by a nurse or attendant trained to this end, is of great efficacy. As soon as the severer symptoms are overcome and the child restored to uniform good health, proper educational measures must be steadily pursued. Remedial measures directed to the removal of functional disturbances—for instance, hydrotherapy,

electricity, especially the static form, massage, and regulated exercises—are of direct value. Strong faradic applications help to overcome hysteric paralyses, particularly in conjunction with encouraging words. The manner assumed by the physician exerts the utmost influence for good or evil. A frank, candid exposition of the patient's need should be clearly given. The medical man should be recognized by the patient as most kindly disposed, encouraging, and yet relentlessly firm.

For the sensory disturbances the cold douche, or alternate use of hot and cold water, or the employment of some of the more picturesque devices, such as metallotherapy, may prove beneficial. Hypnosis will control a certain proportion of phenomena, and is rather easy to produce in children, who at best are very impressionable, but is little better than repeated, direct suggestion at the hands of a physician whom the child has learned to respect and esteem. To overcome a paroxysm or convulsion the following measure may prove efficient: Iced water dashed repeatedly over the face or back, or trickled steadily upon one point, as from a small hose or watering-pot; pieces of ice rubbed here or there on the back or chest, and lastly, inhalations of ammonia or nitrite of amyl. Pressure over ovarian region or in inframammary regions, likewise pressure over the vertex, sometimes stops grave attacks.

HYDROCEPHALUS.

Clinically hydrocephalus is the accumulation of an excessive amount of serous cerebrospinal fluid within the cranium, and is divided into external hydrocephalus, where the collection is beneath the dura and outside of the brain, and internal, where the ventricles are overdistended, and these two conditions may coexist. The distinction is further made between acute and chronic hydrocephalus. The effusion is either slow and passive or rapid and due to irritation. The acute form is rare. Some form of hydrocephalus accompanies all the varieties of meningitis, especially the tubercular; but there is a particular disease, described by Quincke, called meningitis serosa, and considered a purely idiopathic serous meningeal inflammation. The cause of this may be due to injury and the sequel of various febrile diseases and certain other agencies which profoundly disturb the circulation, as the overuse of alcohol in the parents.

The symptoms of acute hydrocephalus are very similar to those of an acute meningitis—retraction of the head, rigidity, nausea, coma, delirium, sometimes fever up to 103° F., sluggish

pupillary reaction, with inequalities, and optic neuritis. In mild cases these phenomena soon subside and full recovery follows. This is what frequently gives rise to the cerebral symptoms which accompany the acute febrile diseases. At other times the disease progresses to a fatal issue.

Chronic hydrocephalus may begin as a congenital imperfection of the brain, due to lack of proper development. This may be confined to one hemisphere, the whole of which may become a huge cyst communicating with the ventricles. The most important form of hydrocephalus, however, is the congenital. Here, during intra-uterine life, the ventricles become distended with a large amount of fluid, which so increases the size of the head as to cause an impediment or a bar to a normal parturition; or, the child surviving, the fluid may go on increasing for days, or to the end of quite a long life. Such a child may be born of apparently perfectly healthy parents, and there may be more than one like this in a family. The actual cause is seldom known, but the various degenerative conditions in the parents are accredited with causal agency, and no doubt are more or less operative. Profoundly disturbing causes acting upon the mother are probably competent to produce a condition of this kind, but, as a rule, only where other causes coexist in one or both parents, as syphilis, tuberculosis, and, above all, alcoholism. Mild congenital hydrocephalus is probably quite common, and recovery is oftentimes so complete that mental development is little or not at all interfered with. It is true that the growth of the brain, under the grave disadvantages of this internal hydraulic pressure, met by the resistance of the cranial walls, is usually so interfered with as to produce varying degrees of imbecility. The brain itself may become distorted and reduced to thin sheets here and there, the white matter yielding more readily than the gray, and yet it is astonishing how fair a degree of integrity of functional activity it may retain.

The **diagnosis** of different forms of hydrocephalus is very difficult and not of much practical importance. If the child is of good vigor, it may survive and acquire a fair degree of intelligence; if not, it will speedily succumb to very slight disturbances. Regular measurements will enable the physician to estimate the increase in the fluid and thus determine the course of the disease.

Treatment is by no means hopeful. In the milder cases iodids and tonics may do some good, along with mercurials and diuretics. The tapping of the ventricles has been advocated and is a safe enough procedure, but the accumulation of fluid

is so rapid that there is little to encourage tne use of this measure.

Lumbar puncture is a simple operation capable of small harm, and is often of much use in the acute forms. We have reported three cases markedly benefited by lumbar puncture, one permanently, and in two the acute overwhelming phenomena of hydrops cerebri were satisfactorily mitigated.

EXOPHTHALMIC GOITER.

This disease, known as Graves' thyroid disease by the English and as Basedow's disease by the Germans, is confined chiefly to adults, but begins occasionally in childhood. Moreover, it is necessary to distinguish between this and an enlargement of the thyroid gland, and also certain disturbances in the cardiac rhythm seen in girls at or near puberty. Again, there are other instances of tachycardia, usually transient, but occasionally most persistent and confusing, as in the case of a boy, a patient of one of us, which baffled the skill of many physicians, finally getting well of itself in spite of overmuch medication. The most frequent cause is excessive emotional excitement, but this is usually superadded to some other exhausting disturbance, and the whole upon a basis of neurotic heredity. Rheumatism and typhoid fever have been quoted as causes, and statistics show a goodly number of rheumatics among exophthalmic goiter patients. The thyroid gland is accused of being responsible as the cause, by an irregular or deficient action, producing a toxin affecting vascular innervation.

The **symptoms** of exophthalmic goiter are rather numerous. The three classical symptoms are: Irregular and overmuch action of the heart (tachycardia), enlargement of the thyroid gland, and protrusion of the eyes. There are certain accessory symptoms, the most important of which are connected with a disturbance of vasomotor control. The skin is usually much relaxed, and there is almost constant sweating, sometimes excessive, which may be localized or general. There is often, too, an apparently causeless diarrhea, seemingly independent of intestinal disturbance, most difficult to control. The kidneys frequently suffer in the same way, as shown by albuminuria and occasional hematuria. In some instances sugar appears in the urine also. There is occasionally disturbance of respiration, and attacks resembling asthma occur.

The most important symptom is the disturbance of the action of the heart, which can scarcely be called organic, although when

unduly prolonged, it may give rise to dilatation or even hypertrophy. The sounds of the heart are not, as a rule, altered, but may be unusually loud, and musical murmurs at the base have been described. The pulse oftentimes runs very high, especially under excess of excitement or slight exertion. Hemorrhages, as from the nose, are not infrequent, also into the alimentary tract. One of us has paid a good deal of attention to this disease, especially in adults, and several cases have been observed, especially in young girls, which seemed to be instances of this disorder, but exceedingly mild. In some of these the tachycardia was absent or only occasionally present, but the enlargement of the thyroid, exophthalmos, the leaking of the skin, attacks of dyspnea and tremor, especially a vibratile quality of the voice, were all observed. The enlargement of the thyroid gland is usually present, but the other symptoms may exist without it. It is likely to follow the development of the tachycardia. The bronchocele is generally of both sides, but one side is usually bigger than the other. The exophthalmos is less constantly present than the tachycardia or goiter, and while, as a rule, of both eyes, may be unilateral or more marked on one side than the other. The cause of this is probably interference with the venous currents, along with arterial congestion. It disappears almost immediately after death. Vision is rarely interfered with. The pupils may be unequal, but of normal reaction. Von Graefe's symptom, long regarded as of importance (a failure of the upper lid to follow promptly the downward movement of the eye), is by no means constantly present, and may occur in connection with other neuroses. There are often, in addition to these phenomena, evidences of mental disturbance or loss of equilibrium, commonly present at some stage of the disease. Patients with Graves' thyroid disease are usually irritable and fretful, but this is not to be wondered at when one reflects how annoying it is, when feeling in other ways pretty well, to be constantly limited in normal energies, to find one's self unable to sustain any ordinary activity without prompt distress. Headache is a not uncommon feature.

The morbid anatomy of Graves' disease is far from being understood, and the theories regarding pathology are still most conflicting. Views as to the toxic origin of the disease, based upon deficient or perverted action of the thyroid gland, obtain rather generally. Graves' disease runs a chronic course for months or many years, but the prognosis, in our opinion, is good. We have seen a number of cases become most comfortable, and several very severe ones become entirely cured.

Treatment.—There is no reason to believe that we have found any specific for this disease. Certainly our own experience in the use of thyroid extract has proved disappointing. The use of some other of the animal extracts may yet prove curative. The extract of suprarenal capsule has given good results. A removal of some part of the enlarged thyroid is a much more rational measure, and yet in most instances unnecessary. Our opinion is that this is a most manageable disorder, and in fully half, if not more, of the cases entirely curable. Attention should be directed first to the vascular erethism, by absolute rest in bed, at least for a few weeks, with graduated return to activities; uniformity in diet, at first milk or its equivalent; careful attention to digestion and elimination; and agents which will tranquilize and control cardiac action. Small repeated doses of hyoscin hydrobromate have given us the best results as a tranqulizer and vascular control agent, along with phosphate of soda or the glycerophosphates, and from time to time the use of the direct cardiac tonics, of which digitalis is the most satisfactory. For the sweating, a distressing symptom, if hyoscin hydrobromate fails to control this, picrotoxin acts admirably, from $\frac{1}{100}$ to $\frac{1}{50}$ of a grain, as often as may be needed to produce an effect. In the vasoconstrictor action and especially where there is defective vasoresistance, the use of Merck's digitalin is of great value, in ascending doses until results are secured. Baths and frictions are important, especially salt, as sea-water. As a direct application to the skin aromatic vinegar is pleasant and effective. Cold to the region of the heart will control tachycardia. For the diarrhea, opiates and the aromatic sulphuric acid are useful, and cannabis indica, with caution; sometimes small repeated doses of podophyllin act even better than astringents. Belladonna and hyoscin are helpful in most stages of the disorder, as well as alkalies, uricacidemia being a pretty common collateral factor. The main reliance is upon general hygienic measures. Other glandular extracts are praised for their effects on this disease, notably that of the adrenals.

RAYNAUD'S DISEASE.

Raynaud's disease, called also symmetric gangrene, is a trophoneurosis occurring rarely, but the sufferers are quite as often children as adults. This disease consists of a localized ischemia or asphyxia, symmetrically distributed. The parts affected are pale and wax-like in appearance, greatly increased by variations in temperature, as when dipped into cold water. The local tem-

perature is lowered, and if the part is pricked, little or no blood comes from the puncture. The regions affected are the fingers and toes, the nose, and sometimes the buttocks and calves. The disease may remain slight and the parts recover their tone. In other instances the disorder progresses and gangrene results, producing a destruction more or less extensive.

Causes.—Raynaud states that the cause for the disease is a condition of arterial spasm. This theory is a perfectly possible explanation of the condition, but some underlying cause must be present to bring about the vasomotor difficulty. Other observers believe the phenomena due to an obliterating end-arteritis.

The **symptoms** of Raynaud's disease have been noted in connection with neuritis and myelitis, locomotor ataxia, and syringomyelia.

The **prognosis** as to life is fair. If the disease destroys tissue extensively, the general health suffers.

Treatment is mainly the raising of the plane of the patient's health. Galvanism and faradism are used with good results, and nitroglycerin in ascending doses at times is efficacious. A prompt removal of the gangrenous parts is indicated.

MYXEDEMA.

Myxedema may be described as a condition of ill health manifesting itself by a series of symptoms of malnutrition. It is a trophoneurosis allied to cachexia strumipriva and sporadic cretinism, which has obtained much attention of late because of the brilliant results of thyroid feeding, relieving what had always been considered an incurable and deplorable state.

The **cause** of this is a lowered or altered activity in partly diseased states of the thyroid glands, the degree of severity being conditional upon the extent to which the destruction of the secreting portion of the gland in question has occurred. Menke asserts it is also a disease of the vascular system, with its characteristic phenomena. Vermehran believes that old age is a chronic myxedema and that the disease in the young is a premature senility.

The **symptoms** of the congenital form are: A hard and glossy skin, stunted stature, a mental state of more or less complete idiocy or imbecility, with lips and tongue thick and large, a subnormal temperature, and great intolerance of cold. The general appearance of a child so affected is characteristically loathsome. Happily, immense improvement is to be expected

from a gradual use of feeding with thyroid extract, ½ to one grain once or twice a day, cautiously increased until three to five grains twice a day may be taken. How large an improvement can be had our experiences in the matter do not as yet enable us to judge. Bruns, of Tübingen, after relating the good results in a number of cases of goiter, says the results of thyroid feeding are especially conspicuous in children.

MIGRAINE.

Migraine, megrim, hemicrania, or sick headache is an exceedingly troublesome neurosis of young people, and occurs frequently in children. It is characterized by occasional attacks of headache, often of one side, with which are associated nausea or vomiting and peculiar visual disturbances, vertigo, and sometimes alterations of sensibility.

Causes.—Migraine is usually inherited, either in its own form or as an outbreak of a tendency to neuroses, among which epilepsy and hysteria are prominent. The disease usually begins early in life, most cases between twenty and thirty, but some between the fifth and the tenth years, and more frequently in the female sex. Exciting causes are emotional disturbances, worriment, fatigue, and disorders of digestion.

The predisposing causes of migraine are overwork, anemia, and general debility, which latter may be primary or be the sequel of some constitutional disease, not infrequently the acute infections.

Symptoms.—The attack may come on rather slowly or quite suddenly, by a physical depression more or less obvious, pallor, chilliness, or disturbance of sight; then comes the head-pain, gradually increasing, for a few hours only or for a whole day. Vomiting or nausea usually accompanies the headache, but this may also be absent, or the nausea may be present and the headache absent—this especially in atypical attacks. Irregularities in the train of symptoms are more likely to be seen in younger children, increasing in severity and completeness of the clinical picture as puberty approaches, after which time it usually persists until early middle life, when, happily, it not seldom disappears. The most characteristic phenomena are the unilateral headache, the sudden and extensive pallor, and the visual symptoms, often transient hemianopsia or hallucinations of sight. The nausea and vomiting are very like that due to cerebral irritation, and sometimes mark the culmination of the attack, followed by relief, and sometimes, again, it is not; but the pain and the vomiting may continue uncontrollable, until the sufferer longs for death. The

most interesting symptom is the visual disturbance, coming on sometimes at the very beginning, or persisting throughout the attack. This may appear as flashes of lightning for the first symptom, startling the patient. Others see bright zigzag lines, balls of fire, or figures of different shapes, the same sometimes recurring in subsequent attacks; others suffer more or less loss of sight, sometimes complete blindness or intense photophobia. The vasomotor phenomena are often prominent: usually pallor of the surface and coldness of the extremities, or the surface may be extremely flushed, and these may alternate in the same attack. When the explosion has spent itself, there follows a considerable exhaustion, as a rule, yet in other cases the patient feels storm-swept and relieved. There are many things in the attack which resemble the explosion of an epileptic paroxysm; but unlike the latter, which tends to get worse, migraine is ultimately outgrown, as a rule, and the sufferer does not exhibit the marks of a degenerate. The attacks are apt to recur with more or less regular periodicity.

Pathology.—The pathology of migraine is not known. It is, however, a cerebral affection closely allied to a sensory epilepsy. There is every reason to believe that changes in the blood supply of the brain or its coverings are primarily responsible for the symptoms of migraine, and that the sympathetic nervous system is largely involved. In addition to the view of its vasomotor origin some observers argue that there must be an inherent alteration of the nerve-cells of the brain. It is a curious fact that whereas in a person subject to migraine changes in the vasomotor apparatus are capable of producing this nerve storm, yet in one without this tendency no such effect is produced. The resemblance between migraine and epilepsy is so close that they may represent different degrees of affection of the cortical structure. Again, it may be the effect of differences in the amount and quality of the secretion of certain glands, as of the thyroid, adrenals, or spleen.

Great care should be exercised in the examination lest some cases of migraine be met, not so typical, which may be confused with what will prove to be a trifacial neuralgia.

Treatment.—For the treatment of the attack very little can usually be done that is at all satisfactory. The stomach usually empties itself, and it is difficult to administer medicines which shall be retained by that organ. Hypodermically many drugs can be given which relieve; of these, small doses of atropin, hyoscyamin, or hyoscin hydrobromate, from $\frac{1}{500}$ to $\frac{1}{100}$ of a grain, are useful. The nitrates have, in our experience,

given satisfaction; nitroglycerin, $\frac{1}{800}$ to $\frac{1}{100}$ of a grain, along with hyoscin hydrobromate, has afforded in our hands much relief. If the stomach will retain them, a host of remedies may be tried, some one or few of which may be found to relieve the individual case.

One of the best remedies for some is an infusion of black coffee, without sugar or milk. Elixirs and syrupy things are liable to disturb digestion, already imperiled. Powders or plain solutions of the coal-tar derivatives suit some people; and a mixture of phenacetin, three grains; caffein, one grain; codein, $\frac{1}{6}$ grain; bicarbonate of soda, five grains, repeated every hour, is beneficial in some cases. Nitroglycerin or the hyoscin salts may, one or both, be given with this, and if the heart is quite weak, three to five drops of tincture of strophanthus; aconite is too depressing. In some cases a small quantity of alcohol is of use—a teaspoonful or two of brandy; this is not to be encouraged. Aromatic ammonia relieves some instances, especially if the stomach is overacid. It is best to avoid strong-tasting preparations.

The constitutional treatment of sufferers from migraine must receive careful attention. Examination of the eyes and proper correction of refraction errors may happily relieve in some cases.

NEURITIS.

It is only recently that the subject of inflammation of the nerves has begun to be recognized or understood, yet the importance is very great.

Multiple Neuritis.

Multiple neuritis or polyneuritis is a term used to describe an acute inflammatory disease of the peripheral nerves and nerve-trunks, characterized by pain, anesthesia, paresthesia, paresis, and muscular atrophy.

Causes.—Multiple neuritis is relatively infrequent in children, since the causes leading to it are much more prevalent in adult life. The common causes for multiple neuritis are poisons of various sorts which exhibit a selective tendency to affect the peripheral nerves. Perhaps the commonest of these affecting children are the toxemias, due to the ravages of micro-organisms of the infectious diseases, tubercle, and the like; this may also be due to sepsis, which follows in the wake of injuries of many sorts. The malarial poison, due as it is to a specific organism, plasmodium malariæ, has been recognized as a cause in a number of instances. These cases are sometimes mistaken for polio-

myelitis, but are usually associated with intermittent fever, during which the disease undergoes remissions. Examination of the blood and spleen will reveal the cause, and quinin produces a relatively swift recovery. The infectious diseases commonly give rise to forms of peripheral neuritis; especially is this noticeable since our recent visitations of epidemic influenza. Diphtheria introduces the most conspicuous and troublesome cases, but differs from the other forms of multiple neuritis in the order in which the various parts become affected. Tuberculosis produces a certain number of cases; so do typhoid fever, smallpox, chicken-pox, and especially syphilis—but the latter causes obtain but rarely in children. Rheumatism is said to account for a certain number of instances; certainly in this disease the course of the nerve-trunks is frequently tender on deep pressure. Exposure to cold is an occasional cause, and excessive cold bathing has been known to produce neuritis. The metallic poisons are powerful factors for harm of this sort. Arsenic has caused a number of cases which have been carefully recorded; so, indeed, has lead. Mercury, carbonic oxid, and phosphorus have in rare instances produced a neuritis.

Alcoholic neuritis, of course, is not a common form occurring in children; nevertheless among depraved families the use of alcohol is more encouraged in the young than might be supposed, affecting not only the peripheral nerves, but producing destructive changes in the liver, kidneys, and brain. Moreover, the appetite for alcohol in children is sometimes not wanting. Alcoholism and tuberculosis in the parents are said to be predisposing factors. Injuries of nerves by fracture, wounds, blows, and direct pressure are followed occasionally by neuritis.

Morbid Anatomy.—In neuritis the changes are chiefly interstitial or parenchymatous, the perineurium usually escaping, and the damage is confined to the peripheral nerves. In some instances the nerve is swollen, infiltrated, and its sheath hyperemic, of a red color, and covered with minute hemorrhages. Sometimes the muscular tissue is involved, the fibers being smaller and paler, the changes there being both parenchymatous and interstitial. One of the most striking peculiarities of the phenomena of multiple neuritis is the fact that the toxins select the peripheral nerves and allow the spinal centers to escape.

The resistance of the more remote nerve-fibers appears to be lessened the further away they are from the mother cell.

Symptoms.—The first symptom of a multiple neuritis resembles an acute infectious disease. There are usually a chill, pains in the back and limbs or joints, simulating acute rheu-

matism, rapid rise of temperature, 103° to 104° F., headache, loss of appetite, coated tongue, constipation; locally, pain, numbness, and tenderness. "The most characteristic feature of multiple neuritis is the association of motor paralysis with sensory paralysis—the distribution of each harmonizing with the other and showing very definite anatomic limits. The paralysis is of the flaccid order, leading at an early date to atrophy of the muscles, and the electric conditions are so altered that we may find almost every possible form of the reaction of degeneration, from a mere loss of faradic irritability to an absolute lack of galvanic response on the part of the nerves and muscles. The distribution of the paralysis is, as a rule, entirely symmetric, and may affect either the upper or lower or all four extremities; it may involve every part of all the extremities, and is the one affection which perhaps more frequently than any other leads to a complete paralysis of every limb of the body" (Sachs).

The characteristic phenomena of the disease are wrist-drop and foot-drop, due to the greater disturbance of the extensor muscles. Sensory symptoms accompany the paralysis, and where pain continues to persist in the muscles and along the nerve tracts, the diagnosis points more to multiple neuritis than to a central trouble. Absence of pain does not impair the diagnosis of multiple neuritis—motor and sensory paralysis is more slowly developed than in central affections, and there is more likely to be premonitory paresthesia. Sensory impairment is pretty equally distributed; at first there may be hyperesthesia. Later, pain may continue, and finally the sense of pain be lost along with the muscular and temperature sense. Tremor and incoordination are frequently associated in neuritis with the loss of sensation and power. Station may be imperfect, the sway excessive, or total inability to stand if the eyes are closed. The reflexes in the affected limbs are diminished or absent, especially the knee-jerk. The parts affected first are the ends of the extremities, and a weakness very early attacks the extensors of the toes, making it difficult for the patient to extend the foot in walking. The muscles supplied by the anterior tibial nerves are the most frequently affected in multiple neuritis, as well as in poliomyelitis, and in the arm the muscles supplied by the musculospiral nerve. The nerves supplying the muscles of the trunk are very rarely affected. The sensory changes are about equally distributed. Pain and paralysis are the distinguishing symptoms of multiple neuritis, but occasionally the one or the other is absent, or, in the case of pain, may have been transient. Electric reactions are extremely varied, both in character and

degree. An important point is the early atrophy, also the absence of disturbances of the bladder and rectum. Glossy skin and edema, common in diseases of the peripheral nerves, are present in many cases, and the peculiar tapering of the fingers. The course of multiple neuritis varies with the intensity of the cause, the symptoms, as a rule, increasing during the first five or six weeks, then diminishing. Both sensory and motor symptoms increase together, and then the sensory symptoms rapidly lessen, the motor phenomena more slowly; this last is due to the atrophy of the muscles and consequent contractures. As the severity of the symptoms subsides, even in the worst cases, recovery is usually steady and complete.

Diagnosis.—The characteristic feature of disease of the peripheral nerves is the close association of sensory with motor phenomena, indicating an involvement of the same nerve areas. Also there are usually not only subjective sensations of pain, but tenderness along the affected nerve tracts. In poliomyelitis the onset and course are more abrupt and violent, and the central nervous system shows wider evidence of disease, and the paralyses are likely to be more one-sided; in neuritis, more symmetric. In poliomyelitis there is rarely much tenderness along the nerve tracts; as a rule, the pains are vague, but liable to be very severe in the early course of the disease. The electric reactions are very similar. Moreover, the two disorders may coexist. At all times the differential diagnosis between these two is difficult. The most important point is to recognize the special cause of the neuritis. Landry's paralysis begins in the legs, first one, than the other, then spreading to the upper extremities. In America, Sachs tells us, the most frequent cause will be found in a preceding acute infection—either by poisoning or by the toxic principles produced in the acute infectious fevers; next in frequency is malaria, and, lastly, tubercular, syphilitic, alcoholic, metallic, or other poisoning.

Treatment.—The treatment of multiple neuritis consists primarily of rest in bed and the removal or limitation of the cause, which is usually a definite one—septic, metallic, or malarial. During the height of the malady the sensory symptoms, particularly pain, require alleviation, and for this heat or alternate heat and cold are best. Next comes the upbuilding of the general health by general hygienic and tonic measures, and finally the repair of the paralyzed nerve and muscle. Warm baths, systematically and frequently given, are useful in most cases to produce a variety of results—relief of painfulness and restlessness, stimulating or tranquilizing effects upon the circulation, and aid-

ing in securing sleep. If the pain is excessive, small doses of analgesics are suitable, of which the best is opium or the coal-tar preparations, used with caution ; the salicylates are not particularly useful ; chloral or strontium bromid by the rectum is sometimes of value. Where the nerve sheath is involved, mercurial inunctions have been used with success, either the unguentum hydrargyrum or a 5 to 15 per cent. ointment of the oleate of mercury. Arsenic is positively dangerous. In the majority of cases general tonic remedies will be sufficient—cod-liver oil, quinin, and strychnin. In the malarial form quinin is necessary as a specific, with perhaps minute doses of calomel to aid its action. When the paralytic symptoms appear, the galvanic current is useful both as a sedative and tonic ; when the faradic current produces contractions, it is useful as a muscle stimulant, but is not to be used where there is hyperesthesia. Contractures may be overcome by gentle massage, later by forcible overextension. If these deformities are permanent, tenotomies and orthopedic apparatus are indicated.

Potassium iodid is of service as an eliminant where much perineural exudate exists.

Diphtheric Paralysis.

Paralysis, more or less severe, follows a large proportion of cases of diphtheria, and bears no relation to the severity of the attack nor to the previous health of the patient, and may occur within the first week or not until several weeks have elapsed. Diphtheric palsy generally follows a particular order ; the palate is usually the first and often the only part affected, shown by the regurgitation of liquids through the nose and a nasal articulation. If this extends, the upper and lower extremities may be affected, at first as a mere weakness and later as a complete paresis, and is generally accompanied by marked disturbances of sensation. The sixth nerve is often affected, supplying the external rectus muscle. Complete oculomotor palsy is rare, but ptosis and weakness of one or more muscles supplied by the third nerve are often seen. The pupillary reaction is often sluggish, with impairment of accommodation. The epiglottis is sometimes paralyzed, and is a source of distinct peril. The reflexes are generally diminished or lost, even in some instances where there is no actual paralysis. Cardiac failure following upon diphtheria, especially where there are irregularities of respiration, is probably due to loss of function of the vagus.

The prognosis is distinctly favorable, though the course may be most protracted. Where a single nerve is affected, the recovery

is more prompt. Hysteric palsies may be superadded to the original lesion, and this possibility must be carefully considered where the case is long in recovering. A return of reflexes and electric reactions points clearly to repair of the nerve, although the muscle atrophy may prove troublesome.

The **treatment** consists of general measures directed to the repair and maintenance of strength. Feeding should be particularly insisted upon, and where the palate is paralyzed, solids are more easily swallowed than liquids. If the difficulties of deglutition are extreme, the nasal tube should be used, or rectal feeding may be necessary. Upon the slightest suspicion of heart weakness cardiac tonics should be given—digitalis, strychnin, caffein, and hot drinks. For respiratory weakness direct excitation of the phrenic nerves by slowly interrupted faradic currents will give good results.

Lead Paralysis

Occasionally occurs in children, as has been proved by the researches of Putnam, D. D. Stewart, Jeffries Turner, and others. It may be most important, and should not be overlooked. It usually occurs in the extensor group of muscles of the forearm and legs, producing wrist-drop and foot-drop. There are usually along with this marked cachexia, pallid skin, severe headaches, and digestive disturbances. The prognosis is favorable for the paralysis, but danger exists from profound nutritional disturbances and the effect of the poison upon the brain.

The lead is only occasionally found in the urine, and in minute proportions when present, confirming diagnosis, but when absent not excluding suspicion. A well-marked blue line is only rarely seen, and chiefly when the teeth are foul, collecting in the sulci between them and the gum. It consists of a deposit of sulphid of lead, and forms inside the gum at its extreme edge, and only opposite certain teeth.

The discoloration commences as minute blackish dots, in many cases only distinguishable by the aid of a lens. The absence of these appearances does not negative the suspicion, and the diagnosis must rest on clinical symptoms. These are: (1) Paralysis; (2) colic and muscular pains; (3) convulsions; (4) ocular neuritis; (5) spurious meningitis (Jeffries Turner).

1. *Paralyses.*—The first paralytic symptom is dropping of the toes in walking, the child adopting a high stepping gait to raise its toes from the ground. All paralyses are bilateral. If the disability is of long standing, there may be secondary contractures, producing a talipes equinus. The arms are not so frequently

affected as the legs, and usually secondarily. The foot-drop is first to occur and last to recover, when both it and wrist-drop occur.

2. *Colic and Muscular Pains.*—Colic is not rare. Constipation is usually present; vomiting occasionally. The digestive disturbances are cyclic, forming "bilious attacks," and occur once in a month or six weeks. Pains in the legs are frequently present and are characteristic. When severe, the pains are in the nature of cramps.

3. *Convulsions.*—The eclamptic attacks caused by lead occur late and early in the poisoning, and can be differentiated from those caused by other conditions only by collateral testimony. They are severe usually, and accompanied by cramps in the abdomen and legs.

4. *Ocular neuritis* occurs, resembling a meningitis. The phenomena are headache, vomiting, a slight squint, depending upon a paresis of one or both external recti muscles, and optic neuritis. In such a grouping the suspicion of lead-poisoning, Turner says, is most grave. Optic atrophy and blindness often result.

Treatment consists of general measures and the administration of iodids in moderate doses, besides warm baths and gentle massage.

TETANUS.

Synonym.—LOCKJAW.

Tetanus is an acute infectious disease of the central nervous system, characterized by continuous tonic spasms, with marked exacerbations, affecting, as a rule, the muscles of the jaw and the back of the neck. There are at times also clonic movements. There is much ground for belief that the primary predisposing cause of the trouble is always an injury, through which the bacilli of tetanus enter and infect; also some favoring condition of the wound or some concurrent infection, or both.

Causes.—The direct cause of tetanus is the bacillus of Nicolaier, a slender rod with rounded ends. Tetanus occurs about five times as often in males as in females, a fact which emphasizes the necessity of a traumatism as the instrumental cause. It occurs most often between the ages of ten and forty years, but may arise at any time of life. The tetanus of the new-born begins, as a rule, between the fifth and tenth day after birth, thence up to twenty days. The entrance of the bacilli here is by way of the umbilical cord, and it must be admitted as possible that

other toxic agents may thus irritate the nerves of a newly born child. Colored persons are more subject to tetanus than white; the filthy much more than the clean, everywhere. Puerperal tenanus is rarely seen where modern surgical principles prevail, in obstetric as well as in surgical practice. The feeble are no more subject to tetanus than the robust. Tetanus may follow the greatest variety of injuries. Punctured and contused wounds of the hands and feet are supposed to be most liable to this infection, but it may follow upon many minor injuries. It is more common in very warm than in temperate climates.

The development of tetanus requires usually a few hours, but may occur at once after an injury or operation, but as a rule takes from one to two weeks and may take four.

Symptoms.—There may be some prodromes, sometimes a chill, indistinct pains about the injured part, or a dull headache; but the first distinct symptom is a feeling of tightness in the jaws, difficulty in mastication, and a gradual stiffening of the muscles of the neck, back, and lower extremity, until opisthotonos is produced, or of the jaws until these are firmly clenched (trismus). Later, the legs become rigid, but the arms escape, as a rule. The muscles of the face assume a characteristic contraction, especially about the mouth, giving rise to a sardonic grin or smile. Now and then the attack is associated with paralysis of the facial muscles. Along with the muscular contractions is pain. The contractions of the thoracic muscles and the diaphragm may imperil life by interference with breathing. Swallowing is also rendered difficult, and the muscular pains grow worse and worse until the child is in agony. All this may cease during sleep, but on the instant of wakening the distress returns with full force. The pulse is rapid and feeble, possibly due to vasomotor involvement. The temperature varies much: in some instances it may remain normal throughout, in others elevated two or three degrees. Sometimes it runs very high, to 108° or 110° F., and is probably then due to an intense effect of the toxins circulating in the blood upon the heat centers. Thirst is often great, aggravated by the profuse perspiration and the difficulties of swallowing water. Urination is irregular, and the bowels are generally constipated. Death, when it occurs, is usually from failure of the heart or asphyxia, from spasm of the glottis, or exhaustion from the difficulties of swallowing food. Most cases die within a fortnight, usually in four or five days. If the patient survives the first two weeks, recovery may be looked for. In tetanus of the new-born those cases in which high fever occurs seem to be fatal.

Pathology.—The essential pathology of tetanus is not yet demonstrated; in fact, no characteristic lesions have been found either in cord or brain. Rigor mortis sets in almost at once. Congestions in different parts and granular changes in the nerve-cells have been demonstrated. The cause of the malady is the bacillus of Nicolaier, which is found in the soil and the dust of dwellings. It is shaped much like a stumpy pin, and is capable of resisting great heat for a long time. These bacilli produce several poisons, tetanin, tetanotoxin, and also toxalbumins, which, when circulating in the blood, are probably the cause of the disease. Oxygen is destructive to these bacilli, which helps to explain why cleanliness limits their action. Bacteriologic researches have helped enormously to explain results and guide in the treatment. Behring and Kitasato have demonstrated the fact that the blood-serum of tetanic animals produces immunity in others, and the animals thus rendered immune have powerful antitoxic qualities, producing curative effects.

Diagnosis.—The diagnosis of well-developed cases following external injuries is easy. Tetanus may be mistaken for hydrophobia, but in this there is no trismus and always a history of dog- or other animal-bite, and the spasms are produced only on attempting to swallow. From tetany a diagnosis may be made by remembering that in this the mode of onset is from the periphery inward, and also through Trousseau's sign, which is that in tetany a spasm may be brought on by pressure on the large nerve-trunks and arteries of the extremities affected, and that this ceases as soon as the pressure is removed. Strychnin poisoning also resembles tetanus, but never begins with trismus. There are also much more rapid development than in tetanus and pains in the stomach, the primal rigidity being in the extremities and posterior neck muscles.

Prognosis.—The mortality in tetanus is 85 per cent. in traumatic cases, in idiopathic under 50 per cent.; a favorable symptom is the length of interval between the injury and the first spasms. Much hope is aroused by the discoveries of Behring, in the matter of immunization, which may in time control the disease.

Treatment.—The treatment of tetanus consists in prevention. Wounds which are made by the surgeon are under absolute control and should not be a source of infection. Wounds of hands and feet incurred by accident should be treated aseptically at once, and small harm will follow. If tetanus set in, general measures must be instituted, bearing in mind the exalted state of motility. Quiet, darkness, and isolation should be secured.

All moving and handling and feeling the patient should be done gently and slowly. If the jaws are locked, a wedge may force the teeth apart to introduce food by tube or otherwise. If this fails, the tube can be passed through the nose, or rectal feeding may be employed.

To limit the spasm, chloroform inhalations are very useful, also nitrite of amyl, which may cause the spasms to be greater at first but lessened afterward. Chloral hydrate helps to produce sleep, and may be administered by the mouth, rectum, or hypodermically; five to fifteen grains may be given at once and repeated several times a day. Opium and morphin are also most helpful. Curare, calabar bean, Indian hemp, belladonna, and other drugs have been much used and with reported good results. Warm baths are sometimes of use. The greatest possibilities exist in the injections of antitoxins or any substances which may hereafter be shown to possess the power of counteracting the poison in the human system.

The action of the antitoxic serum is limited: it can not directly act on the tetanus poison and destroy it, nor undo the damage done; it can only prevent further damage; moreover, a case may go on to fatal termination even after the blood has been rendered antitoxic (Roux). It must be used early and in full abundance to be of value.

In diphtheria the position and character of the lesion are prompt warnings, but the poison of tetanus is insidious, often causing irreparable damage before symptoms show clearly (Lambert). Preventive inoculations are most effective, and should be used in dirty wounds at once, when and where tetanus prevails (Bazy).

To sum up, use local disinfection, physiologic antidotes to tranquilize the disturbed spinal cord, and give antitoxic serum; limit and control progressive action of the toxin.

SIMPLE CEREBRAL MENINGITIS.

Simple cerebral meningitis, leptomeningitis, or purulent meningitis is an inflammation of the pia mater of nontubercular origin.

All forms of meningitis have much in common, and the description of any one is much the same for all, especially the clinical history and treatment, which will be considered together. Cerebral meningitis may be divided into acute, subacute, and chronic.

Causes.—Simple meningitis occurs most frequently in the first

two years of life, then rarely until after fourteen, and between the years of sixteen and forty-five it becomes again much more common. It is essentially a disease of childhood, and is undoubtedly more common than we have evidence to prove.

Exciting causes are the staphylococcus and streptococcus, and other micro-organisms are found by lumbar puncture, as the pneumococcus. The predisposing causes are injuries to the head, extension of the middle ear or of adjacent inflammations, specific diseases, like pneumonia, scarlatina, and erysipelas, pus-producing organisms, emboli, and thrombi. Symptoms simulating meningitis often occur in the progress of acute rheumatism, which reveals nothing postmortem. Trousseau calls these neuroses.

Very slight traumata are many times the probable causes; also the effect of intense heat, as of the sun; likewise acute nephritis.

Symptoms.—The early symptoms are very obscure—a mere indisposition to play, a slight uncertainty or tottering in the gait, a tendency to sit quiet, with some nausea and vomiting. All these phenomena may pass away in a few days, or, again, the vertigo may increase, the headache become severe, the child boring its head into the pillow, swaying it from side to side, and the nausea and vomiting become more frequent. The ejections are of the true cerebral type, quite causeless, so far as the stomach is concerned, and flung straight out of the mouth—"projected." If vomiting occurs independently of food or gastro-intestinal changes and associated with a clean tongue, the probability of its being of cerebral origin is very strong. However, there may well be a coating of the tongue (its absence does not forbid the suspicion of cerebral disease), moderate irregular fever, loss of appetite, constipation, headache, and a general apathy—the patient is really too ill to complain. Gradually the child grows more listless or stuporous, sleeping much and crying a great deal. It may become fretful and restless; convulsions may occur. A common feature is hyperesthesia, especially to light or touch. Should the base of the brain be also involved, the symptoms are identical with those of the tubercular form.* If the patient is firmly grasped or roughly handled, it winces or cries out. There is intolerance of light and sound.

The temperature runs from 101° to 104° F.; the pulse is at

* We know of a child at the Children's Hospital in whom photophobia was so severe that its habitual attitude was that of a tripod: its face buried in the pillow and its two legs well apart and almost straight. It finally died in this standing position, and remained rigid until it was discovered that its spirit had fled.

first rapid, then becomes slow and irregular. At first the pupils are contracted and subsequently dilated and fixed. The neck and limbs usually become stiff. After a time the apathy deepens into coma; convulsions occur later. The deep reflexes are generally increased; the abdomen becomes retracted. The bowels are generally obstinately constipated, and finally the stupor is so extreme that the child seems all but dead—can not take or retain food, and yet lives on. It may be that the sphincters are early relaxed, or only toward the end. There was, for a long time, much importance attached to a local vasomotor palsy following a slight scratch on the skin, called the "tache cérébrale," but this has little significance. All these symptoms may arise in about a week or ten days. Paralyses occur in some cases, very like those due to apoplexy, or may be local, as of the eye. Sight may be lost or suspended. If the case tends toward recovery, all these symptoms gradually pass away; or if toward death, opisthotonos is developed, coma deepens, the sight goes, respiration becomes irregular, usually of the Cheyne-Stokes type, until it ceases. At times perfect recovery takes place, but optic atrophy remains.

Purulent meningitis is associated with middle-ear disease, necrosis of bone, abscess, septicemia, and frequently cerebrospinal or epidemic meningitis. Simple or plastic meningitis may be connected with pneumonia, rheumatism, or some of the specific diseases.

We have reported elsewhere the case of a little girl who, when seven weeks old, was most brutally set upon by an older child and pounded unmercifully; thereupon ensued a miserable sickly state for several months, and finally there occurred an attack very like acute rheumatism, but which proved to be a furious condition of meningitis, and in a month's time she got well. The child has been under our observation ever since, now quite ten years, and although in poor circumstances, living mostly in unhygienic surroundings, is now of magnificent physique but of questionable mentality.

Morbid Anatomy.—In simple acute meningitis the membranes are opaque, characterized by thickening and congestion with infiltration of purulent fluid. The inflammation of the pia is usually accompanied by slight involvement of the dura and the substance of the brain. The exudation may be purulent or nonpurulent; there are increase of the cerebrospinal fluid, opacity of the arachnoid, and edema of the brain substance. The part most extensively diseased is the pia of the convexity, that of the base being usually free. The ventricles are overdistended by fluid. The blood-vessels of the pia become engorged with

extravasation of leukocytes. Postmortem will be found a gluing together of the pia and outer layers of gray matter.

Meningitis is frequently mistaken for typhoid fever, but in the earlier stages there should be no difficulty in differentiating the two diseases. In typhoid fever the patient is dull, apathetic, listless, and though there may be sensory disturbances and delirium, yet the patient is not especially sensitive to external impressions: is rather apathetic. In meningitis, and especially in meningitis of the convexity, among the early symptoms are marked general hyperalgesia and augmentation of all the reflexes. The patient is irritable and restless, picks at his nose and lips, throws his arms about in an aimless manner, perhaps gets out of bed without knowing why, roams about, and again returns to bed. The hyperesthesia may be so great that he can not bear to be handled, and generally there is intolerance of light and sound. Even when the sufferer is lying apparently in a stupor, yet the smallest disturbance or handling may cause him to scream and start.

The reflexes, especially the knee-jerk and ankle-clonus, are generally exaggerated, also the elbow- and wrist-jerks. In the later stages of the disease if effusion has taken place into the ventricles and beneath the arachnoid, these signs disappear. There is great variability in the condition of the deep reflexes, being readily elicited one day and not to be found on the next. In typhoid fever, on the contrary, they are only increased in severe cases, and later in the disease. The fever of meningitis is fluctuating and runs to extremes; that of typhoid is of more regular progression. It is more easily controlled, too. Examinations of the blood will aid in the diagnosis.

Influenza and the other infectious diseases may present cerebral phenomena, but these soon pass away or become subordinate to the other characteristic symptoms.

Diagnosis.—Certain symptoms are common to all forms of meningitis; these are vomiting, headache, irregularity of the pulse, unequal pupils, convulsions, and coma. In the graver forms of meningitis we have, in addition, high fever, evidences of basilar irritation, progressive emaciation, and a rapid increase of all the symptoms. To distinguish between different forms of meningitis is always difficult, and many times will require waiting for later developments, which may be recovery or death, and to be confirmed, if possible, by autopsy. Many acute infectious diseases are accompanied by pronounced meningeal symptoms, which pass away with the severity of the attack.

Course and Prognosis.—A case of simple meningitis con-

tinues for about one to three months. Some cases recover—a very few—and remain perfectly well; there usually follows serious impairment to many organs, the most important of which is the brain. Blindness is not an uncommon result, and many deformities, paralyses, and contractures follow. Where the case tends toward a fatal result, the symptoms grow steadily worse, the respiration becomes more and more feeble, and death results from simple exhaustion or some complication, such as pneumonia.

Treatment.—There are many forms of meningitis, and the principles of treatment are the same, whether these be due to a distinct inflammation of the meninges or mere hyperemic states which arise in many of the infectious processes. The treatment as given here is suitable for all these, with such modifications as may be necessary for special causes. First, place the child in bed in a darkened room and in the charge of a thoroughly competent nurse. The bowels should be emptied promptly; nothing is better for this than calomel, along with or followed by a saline. A good form is $\frac{1}{10}$ of a grain of calomel with two grains of Rochelle salt every half-hour. Cold is useful in the form of ice-bags to the head or neck, but must be sedulously watched. Warmth to the feet is comforting and of value. If the temperature runs high, a warm bath,—85° to 95° F.,—gradually cooled, may be cautiously given. Bromids should be used from the beginning if the stomach will endure them, if not, codein; or if convulsions or restlessness are severe, chloral, two to five grains, by the rectum. The calomel may be continued in smaller doses, or by inunctions of mercury—10 per cent. of the oleate or the unguentum hydrargyri. If the stomach retains well, the protiodid of mercury may be given, or the bichlorid with iodid of potassium, continued for some time.

In the more subacute or chronic cases shaving the head and repeated blisters applied to the scalp are of great service to relieve pain and for their sorbefacient effect.

SIMPLE POSTERIOR BASIC MENINGITIS.

There is recognized a simple, nontubercular form of meningitis occurring mostly within the first year of life, affecting especially the posterior portion of the base of the brain and spinal cord. The cases may be divided into three groups: (1) Those fatal within six weeks, during the acute stage; (2) those fatal at the end of three or four months; (3) those which recover. Corresponding to these variations in the duration of the disease are

differences in the pathologic appearance in the groups 1 and 2. In 1 there is found much lymph over the base of the brain and spinal cord; in 2 there may be no trace of lymph, only thickening and opacity of the pia arachnoid, with adhesions, especially between the medulla and cerebellum. It is an interesting point that in the rest of the viscera or body no lesion is found except such accidental complications as occur in any prolonged disease during the last few days or hours of life. The cause of this is assumed to be a specific micro-organism (diplococcus), which is almost identical with that of cerebrospinal fever.

TUBERCULAR MENINGITIS.

Tubercular meningitis, also called basilar meningitis, is a local manifestation of tuberculosis, usually at the base of the brain, characterized by marked cerebral symptoms due to deposits of tubercles in the pia mater; and, since there is usually effusion of fluid into the ventricles, it is also called acute hydrocephalus.

In many instances the symptoms may be divided into three stages: the first, of hyperemia and irritation of the pia; second, transudation, pressure, and local anemia; third, an overwhelming of the integrity of the centers. Children of tubercular predisposition, or who may be subject to the infection of tuberculosis, are liable to this form of meningitis. Therefore, it is important to note the earliest symptoms of onset, which, if proper measures are then used, might possibly result in cure, although it is doubtful if a true case of tubercular meningitis ever got well.

Causes.—A hereditary predisposition to tuberculosis is the usual origin. Tubercular infection is the direct cause, and this may come from other deposits in the same individual. In children the disease is often apparently primary.

Tubercular degeneration of bronchial glands, which, breaking down, allow the poison to be carried into the circulation, has been pointed out as a potent factor in causation. The direct cause is always the invasion of a poison, which, according to our present knowledge, is recognized to be the tubercle bacillus which spreads along the lymph-channels, exciting inflammation. The chief danger lies in an unusual vulnerability, probably congenital, on the part of the tissues. Abundant opportunity for infection comes also from without, through various articles of food, breast milk or cow's milk, and by inhalation. Bad hygienic surroundings favor its development. (See Tuberculosis.) Most cases occur between the second and seventh years.

Symptoms.—The onset of tubercular meningitis is insidious,

with certain prodromal symptoms: the child becomes listless, dull, and ceases to play; when disturbed, it becomes irritable and exhibits various gastric disturbances, especially nausea, and perhaps for a week things remain much the same. Sleep is somewhat disturbed. If these symptoms fail to disappear, the vomiting becoming more frequent and causeless, the headache more intense and persistent, associated with fever, coated tongue, loss of appetite, constipated bowels, the occasional occurrence of the distressing hydrocephalic cry (a shrill scream caused by intense headache); then our fears becomes graver. If there is then observed slight stiffening of the neck, a slowing of the pulse, and increasing prostration, painfulness on every passive movement, unequal pupils, reacting slowly to light, diminished conjunctival reflex, with clouding of the cornea, convulsive seizures of the Jacksonian type, there is little room for doubt. Attempts at swallowing may be accompanied by slight trismus. Close examination may reveal slight palsies of some branches of the facial nerve of one or both sides. The fundus of the eye discloses a hyperemic and swollen condition of the papillæ, or in some instances optic neuritis. Stiffness of the muscles of the back is nearly always present, amounting sometimes to opisthotonos. Unilateral or bilateral paralysis of branches of the facial nerve occurs, and other changes in the cranial nerves, pointing to an involvement of their base. The "tache cérébrale" is easily produced—a common feature in many states of lessened vasomotor tone. The extremities may be palsied more or less severely, but the degree of this is most difficult to learn, voluntary action being suspended and passive movements presented. The surface reflexes become diminished or lost, but the deep ones in the extremities are, as a rule, exaggerated.

The belly becomes scaphoid, convulsions now and then appear, general in character but not to the extent that the involvement of the pons and medulla would lead one to suppose; at last the paralysis may become more complete, the pupils dilated, and the temperature drop to 95° or 94° F.

The position of the child in bed is usually on one side, with limbs drawn up, fingers clenched over the thumb, head strongly retracted. Later on delirium may develop, with rapid and irregular pulse; the temperature falls; respiration assumes the Cheyne-Stokes type. The duration of this disease is from three to six weeks. In some cases there is greater or less degree of paralysis, due to pressure of the excessive exudate. This paralysis may be of the upper or lower extremities.

Cutaneous reflexes throughout the entire body are lost. Deep

reflexes, as a rule, are increased. It needs to be emphasized that in the course of this disease there are periods when the patient feels much improved; this inspires false hopes in the parents. Often both physician and parents are deceived in this, a recrudescence occurring later, carrying off the lingering sufferer. We have a case in mind where this marked evidence of vitality lasted many weeks, with transient palsies, before final dissolution came.

Morbid Anatomy or Pathology.—There is singularly little to be seen in the macroscopic postmortem appearances of the brain in cases of tubercular meningitis. At the base evidences of the disease are usually apparent: the pia cloudy and protruding. Tubercles are most liable to be found in the interpeduncular spaces and scattered about the pia, pons, medulla, and spinal cord.

There may be no tubercles seen and almost no signs of inflammatory process. But in well-developed and severe cases the presence of small, yellowish nodules along the blood-vessels of the Sylvian fissure are noticed. The disorder, however, belongs to the infectious processes and is a part of a general tubercular infection. There is increase of fluid in the ventricles. The ependyma is edematous and soft. Death is due in great measure to the systemic effect of the tubercular poison and its ravages in other organs.

Diagnosis.—The difficulties of differentiation between the tubercular and other forms of meningitis are exceedingly great. The average practitioner should not allow the basilar symptoms to escape him. An acute ocular palsy or beginning optic neuritis points directly toward the basilar or tubercular form. Symptoms pointing toward an involvement of the convexity, such as the vomiting, temperature changes, etc., occur more frequently than in the other forms.

Course and Prognosis.—Tubercular meningitis lasts from about three to six weeks. Those who die within a week or so exhibit fewer postmortem changes, and death is probably due to a general toxemia. The prognosis is bad enough, but must always be guarded, because the diagnosis is often impossible. We have seen a case at the Orthopedic Hospital, of gravest severity and apparently tubercular meningitis, get well, except that the child became an imbecile.

Treatment.—No care must be omitted in the endeavor to mitigate the sufferings or conserve every possible chance for recovery in the sufferers from tubercular meningitis.

The first thing is absolute rest in a quiet and darkened room; next is a thorough calomel purge and the application of cold to

the back of the neck and warmth to the extremities, if these seem to relieve. Whatever makes the patient irritable or disturbs in any way had best be abandoned. Sleep is much more important than food.

The heart action and respiration must be maintained; for this, digitalis and coffee or the caffein salts are of value. The food should not be given too often, lest the stomachic disturbance thus likely to be caused does more harm than good. Concentrated animal extracts, home-made beef-teas, various broths, and peptonized milk are all easily swallowed and should be given in shorter intervals and in smaller quantities if rejected, but ordinarily two hours' interval is enough.

The iodid of potassium has been recommended for tubercular meningitis, and when used, must be pushed to the utmost. In one recorded case as much as 900 grains were given each day and was followed by recovery. An autopsy three years after in this case proved that the child had suffered from tubercular meningitis.

There comes a time when it may be more merciful to parents, attendants, and also to the child to regard the case as hopeless. Surgical interference has been attempted and the patient recovered. Interference with the knife probably acts *per se* or by "changing the character of the inflammation," as is evidenced by notable cures not uncommon in tubercular peritonitis or in tubercular joint-lesions. When there is marked intracranial tension, the operation of lumbar puncture offers a perfectly safe opportunity for relief of symptoms. This can be readily performed by any one who will learn to make use of this procedure. We have found it most satisfactory both for diagnosis and to afford relief, which is sometimes permanent—at least for the more distressing phenomena.

INFANTILE CEREBRAL PALSIES.

Cerebral palsies occur in children in four forms: spastic hemiplegia, diplegia, paraplegia, and monoplegia. The onset of these is in three periods: (1) During intra-uterine growth; (2) during labor; (3) after birth. They occur more frequently in the earlier years—up to ten, mostly before three; 7 per cent. are congenital. The palsies are spastic in type (tending toward spasm), and may be of one side (hemiplegia); of both sides (diplegia); of one half of the body below a certain level (paraplegia); of one limb (monoplegia); this last is very rare. Certain special features are common to all these forms of palsy:

rigidity of the muscles, contractions of tendons, and exaggeration of all the deep reflexes. Convulsions and coma commonly precede the diseased state. Most cases of diplegia and paraplegia are congenital, while most cases of hemiplegia are acquired after birth (Peterson).

Causes.—Prenatal cerebral palsies are due to many causes. Trauma to the mother during gestation, especially septic processes, and such as powerfully disturb the circulation; the toxins of the zymotic fevers, pneumonia, anemic states, along with frequently degenerative changes in the blood-vessels, are the common causes.

Convulsions in the mother often result in retardation of fetal brain development; so do psychic and emotional shocks and nervous and other strains.

The chief cause of paralysis during parturition is a slow labor, exercising a long-continued compression on the fetal brain and circulation, producing meningeal hemorrhage or thrombosis. This is most common in first-born children. The use of instruments to relieve this tardiness, though it may occasionally work havoc, yet affords rather a means of prevention in most instances by relieving the overprolonged, intracerebral blood pressure. Mere rigidities are the result of surface lesions; the more profound the palsy, the deeper the lesion.

Acquired paralyses are largely due to the acute infectious diseases. Whooping-cough and pneumonia, by repeated and severe acts of coughing, superinduce vascular engorgement, from which may result escape of blood and cortical damage.

Traumata, fright, and various forms of convulsions are instrumental factors many times, especially in those of feeble resistance and neuropathic predisposition.

Symptoms and Description.—The cortex being the usual seat of lesion, convulsions and coma are customary symptoms of onset. After a difficult or prolonged birth, or one not conspicuously tedious, there may soon appear in the baby cyanosis, asphyxia, or convulsions. The infant may exhibit none of these, but only extreme feebleness. If cerebral damage has occurred, however, there will later be noted imperfect or delayed coordinations, awkwardnesses, grimaces, etc., some of which will pass away, yet much will remain or change to rigidities, athetosis, and the like. The continuance of convulsions constitutes epilepsy, a common result of the characteristic lesions.

The paralysis is most obvious in the limbs, taking the form of hemiplegia (of one side), both arm and leg being affected more or less; in both arms and both legs (double hemiplegia or

diplegia); in both legs (paraplegia); or, very rarely, in one limb only (monoplegia).

When the leg and arm are both affected, recovery takes place first in the leg and later in the arm, but this result is seldom perfectly attained. In a few instances all recognizable palsy disappears, leaving other phenomena to mark the central damage. The face is sometimes involved, commoner in the diplegias; one side of the face may be paretic and the other contracted.

Speech defects remain in a large number of cases, especially the congenital variety and earlier palsies, and this from damage of whichsoever side. Centers for articulate speech are not determined in the left side very early, and their development is easily interfered with.

Exaggeration of the deep reflexes on the injured side is the rule, though in a small proportion of cases these are lessened or normal. Contracture and rigidity mask this phenomenon at times. In a certain few cases of arrested cerebral development the palsy is flaccid.

In our experience the knee-jerk and arm-jerk are markedly increased, as a rule, and ankle-clonus and ankle-jerk are generally to be elicited in excess (the lesion being in the first division of the motor tract).

The gait is characteristic, consisting of a springy action of the leg, which is dragged forward with an obvious effort and planted with a jerk. The shoes on the palsied leg show evidences of extra wear. The arms are waved about and extended overmuch in the effort to balance the body, which shares in the spasticity of the limbs, especially while in action, one voluntary movement helping to reinforce that of other parts. The foot, too, comes to earth with the ball or toe down, and the sufferer pitches toward the affected side and then places the sound foot less in advance than the other.

In diplegia and paraplegia there is a doubling of this strained effortful gait. The absence of one sound limb to support the other, with the consequent loss of balance, causes each leg to describe a half circle or more, and the foot to cross over in front of the other.

In one typical case in our practice, that of a peculiarly vigorous girl, she swings along with fair speed, occupying much space laterally, hands extended or poised, resembling a bundle of steel springs vibrating, and is merely a vivid illustration of the usual type of progression.

Postparalytic disturbances of motion are notable features, being more common in the child (one-third of cases) than in the

adult. The forms most common are, in their order of frequency, choreiform, rhythmic, and associated movements. To these may be added the contralateral adductor spasm, which one of us studied carefully.*

The choreiform movements, described first by Weir Mitchell as "postparalytic chorea," are easily and frequently mistaken for chorea. This can be differentiated by the exalted state of the deep reflexes, contractures, tremors, etc. These hyperkinesias or exaggerations of movement may follow other states than paralysis, as the athetoid movements in the fourth of Freud's diplegic types (Mills). The atrophy often seen is not a true muscular wasting so much as a failure to develop from restricted activities.

In most cerebral palsies there is more or less obvious asymmetry of both the body and skull. Along with deformities of the cranium and other evidences of degeneracy, the most distressing symptom of cerebral atrophies is the epilepsy so commonly present. The palsy may fade away and leave this blight for life; which, by the way, it aids materially in shortening. Idiocy or imbecility very often is a resulting and conspicuous feature: often in diplegias and paraplegias, there being here a double lesion involving larger areas of brain structure.

Morbid Anatomy.—In the case of cerebral palsies occurring before birth the lesion is usually a wide-spread meningeal hemorrhage involving both hemispheres. This may merely check development or produce loss of tissue, and is most destructive to functional activity, bodily and mental. Death, happily, occurs often at once or very early, nor do the sufferers survive long, as a rule.

There may be found porencephalia (limited absence of brain tissue) or cysts, confluence of fissures, or other conspicuous deformities. In addition there are more minute changes, such as defective development of the cellular elements in the cortex and pyramidal cells, constituting *cortical agenesis*. Epilepsy is a common result, while imbecility is the rule.

Pathology.—The resulting lesions of acute apoplexies are not so clear, but consist of atrophies, sclerosis, and other changes due to hemorrhage, also embolism and thrombosis. Fatty degeneration of the blood-vessels is the probable explanation of the escape of blood in a large number of cases; also the more delicate and vulnerable condition of the blood-vessels in the young. Heart-lesions, pneumonia, and other infectious diseases

* "Internat. Med. Magazine," June, 1895.

predispose to embolism. The form would probably be softened and hemorrhagic areas, with ruptured vessels, leukocytes, granular cells, and neurogliar proliferations (Mills).

Whatever is the initial lesion of an acute cerebral palsy, when the patient survives secondary changes occur concealing the first cause, and hence arise atrophies, areas of softening, sclerosis, and the like. The sclerosis is largely responsible for the imbecility and epilepsy, transverse fibers connecting intimately all parts of the hemispheres.

Summary of the Effects of Cerebral Palsies.—The face is occasionally affected, but recovers most rapidly and completely. Palsy of the muscles of the eye now and then persists, especially strabismus. Defective speech is common in all cases, due to a variety of causes, mechanical as well as intellectual. Aphasia occurs in which the lesion is on the left side as well as on the right. The deep reflexes are exaggerated, especially in the paralyzed limbs, but may occur in both, even in one-sided palsy. In 5 per cent. these may be normal, lessened, or absent. Rigidity in the limbs may mask this, especially the ankle-clonus or triceps jerk; morbid movements are exceedingly common. "Athetosis," or restless ataxia, occurs in 20 per cent. of the cases. There are frequently also associated movements and imitation, by the hand or limb not in use, of the movement voluntarily made by the opposite limb. Choreiform movements are more frequent in hemiplegias and rare in diplegia; other disturbances of movement are rhythmic contractions, tremors, tetanoid states, and nystagmus. Rigidity and contractures are common and graphic features of nearly all these palsies; hence they are liable to apply to the orthopedic surgeons rather than to the physician, and the orthopedist should in all instances take charge of these cases and relieve deformity to the uttermost possibility. The adductor spasm of the thighs induces a crossed-leg progression which impedes movement very much; this in most instances can be partly relieved by tenotomy and overstretching. Talipes equinovarus is also common in hemiplegics. It is customary in all forms of cerebral palsy to find rigidity with contracture, but occasionally a case of flaccid paralysis appears, and this is probably the result of an arrested development rather than of a degenerative change. There is much less trophic disturbance than in spinal palsy; nevertheless, there is a localized retardation of growth, especially in the cases beginning early, the limbs developing in fair proportion, but much more slowly, failing to attain the full size and vigor of the opposite limb. The whole organism suffers; full stature is almost never attained.

Occasionally there is seen the same localized blueness and coldness in the extremities observed in spinal palsy. Spinal lesion may coexist with the cerebral. Epilepsy occurs in 45 per cent. of all cases of cerebral palsy. The convulsions are usually general, but in 15 per cent. they are focal or Jacksonian. It is essential always in examining an epileptic to search for evidences of a cerebral palsy. Feeble-mindedness, imbecility, and idiocy are also often met in direct ratio to the extent of the pathologic process; more commonly in diplegias and paraplegias, because of the larger areas of brain involved. Mental defects are rarer in hemiplegics, although in nearly half the cases of cerebral palsy of whatsoever degree there is evidence of mental deterioration. There will also be seen the various stigmata of degeneration, cranial deformities, asymmetries, Gothic palate, deformed ears, hairiness, etc.

Prognosis.—It is far from unfortunate that children marked from the beginning rarely survive; those who do are liable to develop imbecility as well as epilepsy, and become irretrievably lamed or stunted in mind and body. No opinion can be formed as to the degree of crippling or capacity for development in the congenital forms until after some weeks or months have elapsed. In the double-sided form of brain palsy mental development is most likely to be lacking. So long as contractures remain absent we may hope to recover a fair capacity of muscular coordination.

Differential Diagnosis.—Infantile cerebral palsies are frequently confounded with acute spinal affections. The cerebral cases are characterized by spastic rigidities, contractures, increase of the deep reflexes, normal electric reactions, and very slight atrophic changes. The forms of palsy are hemiplegia, diplegia, and paraplegia, with, very rarely, monoplegia; frequent accompaniments are epilepsy, imbecility, and morbid movements. Very mild cases exhibit almost no spasticity or contracture, but rather athetoid or choreic movements; the spinal and the cerebral forms of palsy may coexist in the same individual, arising at different times, and such a complication must not be overlooked. Cases of persistent chorea should be most thoroughly searched for evidences of hemiparesis with mental defects or occasional epileptic attacks, which often are obscure, manifested rather by mental states than disorders of motion.

Treatment.—Recognizing the localized form of the lesion, along with the triumphs of modern surgery, it would seem a most promising possibility to take away a well-defined clot and thus remove the cause of the trouble; but, alas! the published results

of operative interference in cortical hemorrhages of infants and children are most disappointing. The highest authorities agree that the best treatment for infantile apoplexies is almost entirely expectant. Absolute quiet, cold to the head, a clearing-out of the bowels, come first; for the convulsions, inhalations of chloroform, or, better, chloroform, three parts, ether, five parts, and nitrite of amyl, one part, are very efficacious. (See Treatment of Convulsions.) After a few days begin with small doses of bromid (and add to this, later, an iodid), continuing for some time. Keep the child perfectly quiet. Feeding should be of the simplest, and, if necessary, by the rectum. No change of posture should be permitted to the child; all shifting of garments should be made by the nurse and with the utmost care.

Counterirritation, mustard baths, and the like are merely offensive meddling, unless there is marked excitement, when if they do no good, they may do little harm. Calomel is of value to secure free purgation. The bromids and chloral are better given by the rectum. Soon the parents will desire treatment for the paralysis and other symptoms, and this, of course, must be forthcoming; but they must have the nature of the lesion explained, making it clear that it is a damage wrought which becomes almost at once a chronic disorder and not an active disease. During the earlier acute processes quiet is imperative, but in a month or two (judged by the grade of recovery) the paralyzed limbs may receive attention in the way of bathings, massage, and electricity, disturbing the brain as little as possible. The form of electricity to be chosen is mildly increasing faradism; galvanism is not required at all. The electricity serves a valuable purpose in enforcing muscular activities which are beyond volitional control. The degree of current to be used is to be chosen empirically, the gage of which is a moderately full reaction, compared with similar healthy muscles in the same child. Our rule is to produce fifteen or twenty good strong contractions by means of the slow, interrupted current, to be followed by from three to five minutes' steady application of the rapid interruption to each half of an affected limb. This is quite enough daily for a month; in the second or third month this amount may be doubled or trebled at two or three daily sittings.

Next comes massage, which must be given with the greatest delicacy; first simple centripetal strokings for a week or ten days, then cautiously increased gentle frictions, and, by the end of a month or two, deep, thorough, slow muscle-kneading and rotation of the muscle masses may be given. Of extreme importance are extensions, counterextensions, and rotations, to prevent and to

remedy contractures. Indeed, there is no one agent which helps to restore a paralyzed limb to activity so powerfully as these overstretching movements. The brain centers seem to be thus stimulated. Undoubtedly, well-adjusted apparatus can do much. Once the contractures have been thoroughly formed, the orthopedic surgeon must be consulted, and splendid results are obtained at his hands.

For the athetoid choreic movements much help can be afforded by fixed dressings and other forms of restraint.

Far and away the most important duty of the physician is to control the epilepsy. This is due to secondary changes in the brain, the outcome of the original lesion, and is focal in character, although not always strictly Jacksonian. Here operative interference promises great things, and is to be recommended when fairly indicated by a clear localization. It may be necessary to continue the use of bromids or other depressomotors. Here trional serves a good purpose, also sulphonal, antipyrin, and acetanilid, as described at length under Epilepsy.

TUMORS OF THE BRAIN AND ITS MENINGES.

New growths within the skull in childhood, while rare, have of late been studied so carefully that statistics seem to show them to be far more common than has been supposed. Peterson has collected accounts of a total of 335. The largest number of these are due to tubercle. Glioma and sarcoma are next most common. Cysts are comparatively frequent, resulting usually from some preceding morbid process. Carcinoma and gliosarcoma follow in frequency. The site of the tumor is most often the cerebellum—in more than one-third of the cases. The next most common situations are the pons, centrum ovale, basal ganglia and lateral ventricles, corpora quadrigemina, and crura cerebri. Tumors of the cortex come next, and the other situations, more rarely showing, are the medulla, fourth ventricle, and base of the brain.

Causes.—The causes of brain-tumors are exceedingly obscure. Certain new growths arise by extension from deposits of a similar nature in other parts of the body, especially tubercle ; this is also true of sarcoma and carcinoma. Accidents often credited with causal agencies are of doubtful potentiality.

Symptoms.—In recording those symptoms which seem to point to new growth in the brain it is of the utmost importance to be most clear and exact as to the order in which the phenomena began, for upon this will many times hang the possibility of

localization or an estimate of the extent and character of the growth. It is also necessary to record almost every minute detail of history with elaborate explanatory phrases. Thus, and thus only, can the testimony be sifted down by an expert and moderately exact knowledge be obtained. The possibilities for help are small enough, but such as exist must be sought for with the utmost solicitude.

The symptoms are divided by Sachs into two groups: the first includes the general symptoms resulting from pressure, and the second includes those due entirely to the location of the tumor. Another very important point is to estimate the degree of rapidity by which the tumor grows, for even the most delicate structures will slowly adjust themselves to pretty extensive pressure, whereas a rapidly growing neoplasm, no matter how small, will markedly derange function. The vascular supply is an important factor to estimate, and the disturbance of large blood-vessels is almost as grave as that of nerve tracts. The symptoms which point to a new growth within the brain are headache, nausea, vomiting, insomnia, convulsions, and double optic neuritis. Headache in children, especially very young ones, is often not clearly evidenced, but, nevertheless, much of the emaciation and weakness resulting from cerebral tumors is due to the persistent insomnia and suffering caused by headache. The character of the headache, when the child is old enough to describe it, is intense, distressing, deep-seated, and usually referred to that region of the head which adjoins the new growth. When along with this there are nausea and vomiting, practically causeless, we may gravely suspect an intracranial growth, especially where these continue for a considerable length of time. Vomiting is of the cerebral type, coming suddenly at almost any time, often as a complete surprise to the child, and projectile—thrust straight out—or induced by the slightest disturbance. There is also occasional or more or less vertigo, especially associated with cerebral tumors or those of the pons. Convulsions, too, common as they are in children and due to slight causes, add to the gravity of the picture if associated with headache and vomiting, and especially if all these are repeated. Localized convulsions may point to an area of cortical involvement. Double optic neuritis, due, probably, to increase of intracranial pressure, if along with continued headache and vomiting, completes the clinical picture of growth within the brain. This may not interfere with vision and hence may not be suspected. A moderate familiarity with an ophthalmoscope is usually sufficient to investigate so conspicuous a symptom. We were able, on one occasion, to thus confirm a

suspicion of cerebral tumor in an out-of-the-way country place with an ordinary head mirror and pocket lens. This change is usually observable in both eyes, although appearing in only one for a long time. Along with these conspicuous general symptoms are more or less well-marked disturbances in pulse-rate and respiration. The localizing symptoms are numerous, but are not, as a rule, capable of being interpreted by the general practitioner, but are exceedingly important for him to recognize, enumerate, and record. The first of these, called the MacEwen symptom, is percussion over the skull, which brings out local tenderness and increased dullness. This is not always significant of tumor, but may also indicate abscess or overdistended ventricles. Nor is this altogether to be relied upon, even by the most skilful. It is best elicited by auscultatory percussion. Following these indirect or localizing symptoms, as admirably elaborated by Sachs, we may note that tumors of the cortex are not easy to differentiate from those of the subjacent white matter, although the order of development will aid us. Tumors of the motor area, in or near the gray matter, are liable to give rise to convulsive seizures from the start, whereas those beginning in the underlying white matter are more likely to produce gradually appearing paralytic phenomena, and subsequently those of direct cortical irritation. Moreover, the meninges lying most nearly adjacent to the cortex, disturbances thereabout are more liable to produce intense headaches and convulsions.

Tumors of the frontal lobe are lacking in localizing symptoms, except such as have to do with producing changes in character or intelligence, or, if low down, in the functions of the olfactory bulb, and possibly disturbances in salivation. The third frontal convolution, in which reside the motor centers of the speech function, may exhibit motor aphasia or agraphia. If along with these there should be seen localized twitchings, as in the arm or hand, we may suspect trouble in the motor areas of the cortex or lower tracts. Tumors of the parietal lobe are said by Dana to be followed by sensory changes in the limbs of the opposite half of the body; word-blindness is also likely to accompany disturbance of the parietal lobule. Disturbance of the vision may arise from pressure in this locality, although the chief seat of disturbances of sight has to do with pressure in the occipital lobe, especially the cuneus. The temporosphenoid lobe contains the centers for hearing and for speech, and growths in this region frequently give evidence of their existence by impairment of hearing and by sensory aphasia. Tumors, even very small ones, in the line of the great motor tracts, in the basal ganglia,

especially the internal capsule, give rise to a wide variety of motor phenomena. Tumors of the crura cerebri are to be recognized by the early association of paralysis of both motion and sensation in the opposite half of the body, along with oculomotor symptoms, ptosis, paralysis of the muscles governing the eyeballs, the iris, and the ciliary muscle. The close juxtaposition of both peduncles may give rise to paralysis of both halves of the body, or possibly double ptosis or double oculomotor symptoms. Tumors of the medulla oblongata produce symptoms similar to those met with in bulbar palsy, as well as disturbances of the centers in the fourth ventricle, including disorders of deglutition, in respiration and the cardiac movements, and with increased urination or glycosuria. They are bilateral in character, owing to the close juxtaposition of the two halves of the brain at this level. They also involve disturbances of sensation and partial or complete hemianesthesia. Tumors of the cerebellum produce, in addition to the general symptoms enumerated, a peculiar and extensive vertigo or reeling gait, known as cerebellar titubation, resembling the staggering of a drunken man, and attributed to a special disturbance of the middle peduncle. Giddiness is a much more constant factor in cerebellar than in other brain-tumors; so are affections of the sixth nerve, with a resulting paralysis of the rectus externus muscle. The seventh and eighth nerves are also frequently involved, and phenomena due to this will aid materially in confirming the diagnosis. At times symptoms of cerebellar tumor are by no means marked, or differ but little from those in other parts of the brain. Paralysis of one or both sides follows upon an extension to the pons and oblongata; the reflexes are liable to be exaggerated, but may be diminished or lost.

Diagnosis.—Brain-tumors are to be differentiated from chronic hydrocephalus, meningitis, abscess, and cerebral hemorrhage. In the case of meningitis this should not be difficult if the history of the case is clearly obtainable. Solitary tubercles, producing more or less mischief, may be associated with meningitis; the cranial nerves are progressively disturbed, and it may be with relatively slight morbid phenomena. Abscess generally affords some history of septic process, and is usually accompanied by fever and not by optic neuritis.

Treatment.—In the light of our present knowledge very little can be expected in the way of treatment for tumors of the brain, except possibly to relieve some of the more serious symptoms. Postmortem findings show that even with moderately good localization the tumors are, as a rule, practically inoperable.

Absorbents, such as mercury and the iodids, are of more or less use to reduce the pressure of the cerebrospinal fluids, and by this means localized headaches and nausea may be mitigated. These drugs should be given in increasing doses to the verge of toxic endurance. Headaches are relieved by the coal-tar analgesics and opiates. It is a questionable service to prolong the life of such sufferers unduly, and yet we are certainly not justified in withholding any reasonable means for relieving distress.

ABSCESS OF THE BRAIN.

Abscesses are occasionally found in the brains of children, either superficial or deep, or in one or the other hemisphere, and more often in the white matter. They generally arise from suppurative processes in the middle ear, and on the same side as that of the affected ear, although it may be on the opposite. The symptomatology is extremely obscure. The search for a cerebral abscess is a most uncertain quest, and they are not seldom demonstrated post-mortem, to the surprise of all concerned. In the more acute conditions we have the ordinary symptoms of sepsis,—chilliness, fever, emaciation,—along with the symptoms of cerebral tumor, headache, convulsions, vomiting, giddiness, together with local tenderness of the scalp and occasionally optic neuritis. The temperature may be subnormal; there may be paralysis, which is apt to be of one side.

The **treatment** is chiefly prophylactic, by giving especial care to the prompt and thorough treatment of ear diseases. Early operation has occasionally brought about satisfactory results, and should always be hopefully considered, although little has as yet been done to justify expectations based upon these views, which are in the main theoretic.

INFANTILE SPINAL PARALYSIS.

Synonym.—Poliomyelitis Anterior Acuta.

Acute anterior poliomyelitis, myelitis of the anterior horns of the spinal cord, atrophic spinal paralysis, infantile or the "essential" paralyses of infancy, etc., is an acute febrile disease of probably infectious origin and rapid development, producing extensive paralysis, some part of which is permanent, followed by muscular atrophy, imperfect bone development, and deformity.

Causes.—The majority of cases occur before ten years of age; three-fifths before four years; it is rare before six months,

but in the second six months susceptibility is greatest. Heat is shown by Sinkler to be a powerful predisposing factor; four-fifths of the cases occur in summer, mostly in July and August; Sachs asserts that 75 per cent. arise between July and October. A rapid chill of body has also been shown to excite the onset of the disorder, a condition which may occur as well in hot as in cold weather. Fever of various kinds are often blamed, but the diagnosis of the symptomatic initial fever can seldom be differentiated from those ushering in the infectious or other inflammatory processes. Slight injuries are reckoned as adequate causes by some, but all such histories need to be rigidly sifted. A specific cause of microbic kind is almost certainly behind the accidental ones.

Poliomyelitis represents an acute inflammatory process of the anterior gray matter of the cord, and the only satisfactory explanation of this is to assume an infection which tends to select a location in the cord.

Pathology.—Poliomyelitis is admitted to be an acute inflammatory condition of the anterior gray matter of the spinal cord. It is assumed, on good grounds, to be due to an acute infection which shows a predilection for the cells of the spinal cord, just as other acute infectious diseases choose their customary sites. All the clinical facts point to a microbic cause, but this is not yet proved, although the fact that it has appeared epidemically further strengthens the assumption. Of late the theory has been advanced that the micro-organism gains access to the system through the gastric mucosa.

Goldscheider's studies lead to the reasonable conclusion that a condition of irritation is present in the walls of the blood-vessels of the cord, leading to their dilatation and to the proliferation of their endothelial elements. Later degenerative changes occur in the ganglion cells, as well as in the nerve-fibers appearing in the vicinity of the altered blood-vessels.

The inflammatory process is interstitial, not parenchymatous, and may be limited to a few segments of the cord, or extend to the medulla and pons. The muscles become atrophied, the fibers diminished in size, possibly disappearing, their places being filled by adipose tissue. The bones, too, become smaller and denser.

Diagnosis.—Poliomyelitis in the earlier stages may be readily confounded with acute cerebral disturbances, as meningitis and apoplexy. In meningitis, however, there are vomiting, rigidity of the neck, headaches, and affections of the cranial nerves. In poliomyelitis these do not appear, and convulsions and coma are

brief. In well-pronounced acute cerebral palsy the differences are clear, but if less marked, difficulties arise. The phenomena of onset are much alike, but the clinical features are in strong contrast.

Acute Spinal Palsy.	Acute Cerebral Palsy.
Onset sudden, with fever, coma, and convulsions. Convulsions rarely repeated after first few days.	Onset sudden, with fever, coma, and convulsions. Convulsions apt to be repeated.
Paralysis flaccid, associated with atrophy.	Paralysis spastic; no atrophy; associated with rigidity and contractures.
Paralysis widely distributed, possibly involving all extremities, or narrowly limited to one member or even a single group of muscles.	Paralysis generally hemiplegic, sometimes diplegic or paraplegic. Monoplegia rare.
Electric reactions altered (R. D.).	Electric reaction normal.
Deep reflexes diminished or lost.	Deep reflexes exaggerated.
Intellect never permanently involved; no epilepsy.	Intellect often involved; epilepsy frequent.—(*From Sachs.*)

Between poliomyelitis and peripheral (multiple or simple) neuritis the diagnosis is often difficult. In both the onset may be sudden, but it is more slow in neuritis, as a rule.

There is less evidence of general nervous disturbance in neuritis usually, but where this is the result of a distinct toxin, the poison may produce cerebral phenomena very like those symptoms in the early stages of poliomyelitis.

Pain along nerve-trunks is more pronounced in neuritis and of longer duration; but the degrees of this are hard to determine in children. Atrophies, electric reaction, and reflexes may be the same in both. Muscular dystrophies may be mistaken for poliomyelitis and it for them, especially the peroneal form of progressive muscular atrophy (Charcot-Marie type). Atrophies are more progressive, are bilateral, slow to progress, do not retrogress, and have incomplete electric reaction.

Symptoms.—Acute poliomyelitis comes on suddenly without distinct prodromes, much in the manner of onset common to the acute infectious diseases, with fever, vomiting, sometimes convulsions, and, rarely, coma. All these may be so slight as to escape notice until the motor disabilities are manifest. These symptoms last a few hours or days and gradually subside, leaving the paralysis. There is often tenderness along the affected nerves. The palsy is of the flaccid kind, like all those depending upon lesions of the second division of the motor tract, and includes the ganglion cells in the anterior horns, the anterior nerve-roots, peripheral nerves, and the muscle. This is associated with atrophy in the affected parts. The electric reactions are altered almost from the first. The reflexes are diminished or

lost. The fever is seldom above 103° F., and more often is very slight. It lasts for a day or two, but in severe cases of this disease may continue with variations several days. Vomiting is quite a constant feature, occurs early, and is independent of gastric disturbance, often projectile, resembling that which occurs in cerebral disease. The convulsion, a by no means constant phenomenon when present, is general, not localized, as is usual in acute brain troubles. There is sometimes well-marked tenderness along the nerve-trunks, and even pain on passive movement of a limb, giving rise to the suspicion of a neuritis and making the diagnosis somewhat troublesome. This was common to several of the cases in an epidemic of poliomyelitis seen by one of us, occurring in August of 1896, in Cherryfield, Maine.

The diagnosis between the spinal and cerebral types of paralysis can oftentimes only be made in the light of subsequent phenomena, the form of palsy, the electric conditions, and the atrophy. The palsy at first is extensively distributed and may involve all four extremities. This subsides rapidly, and those parts which are to be permanently damaged remain obviously impaired. The atrophy of the muscles is seen sometimes as early as the third day, and often in the first ten days. The wasting is in the line of distribution of the loss of power, and a limb or muscle is readily seen to be smaller, even in fat subjects, than the corresponding parts. It feels limp, flabby, and cool, with vasomotor changes in the skin, occasionally a notable cyanosis, and other evidences of inactive nutrition. The weaker muscles are at the mercy of the stronger ones; thereby contractures are produced. Shortening takes place, too, because the atrophy involves the bones also. The skin frequently appears shriveled, becoming pallid, cold, clammy, and bluish. The blood supply is lessened, being no longer needed to the full amount, and the vessels themselves suffer shrinkage.

The electric reactions are most important. The paralyzed muscles and nerves exhibit the reaction of degeneration, the anodal closure contraction being equal to or greater than the cathodal closure contraction. At the very first (Sachs) the faradic and galvanic response may be increased, soon to be lessened or lost; the rule is that reaction to the faradic current is lost at once, but to galvanism it remains or is increased for some time and then is lost, except that it may appear to very strong currents. If response to very strong faradic excitation is retained, we can be hopeful of restoration to fair functional power. If this is absent for a long time, the power of these muscles is

gone. In the later stages, also, of the disease, if there is a return of faradic response or a normal behavior to galvanism, this enables one to predict at least a partial recovery. The restoration to power or size is rarely complete, although an excellent functional activity may be regained.

The reflexes are diminished, at least those associated with the normal function of the paralyzed part. The knee-jerk is lost in the majority of cases, but if the disturbance is in the upper cord, it may persist, and also if an isolated muscle or group of muscles only are affected. If all the muscles in a limb are palsied, it hangs entirely limp, like that of a doll (the Punchinello leg). The gait of a sufferer from poliomyelitis, where one leg is entirely flaccid, is thoroughly characteristic, and is much like that of a person walking on an artificial limb. Where there is only one or a few muscles affected, the gait may be altered very little, and if the bone growth is not interfered with, such persons enjoy great activity and are only somewhat impaired in power. The disablement is not nearly so great as in the spastic type of cerebral palsy, where the usefulness of the limb is disturbed by lack of control of what are often vigorous muscles. Permanent overaction is shown by the contraction of the strong muscles, causing the weaker ones to give way, offering no balancing opposition. Pain may be present from the very first, but does not last long. Usually there is some tenderness along the affected nerves. The bladder and rectum are not involved, as a rule. The brain is not affected at all, except possibly for the first day or two, and poliomyelitis leaves no mental defect whatsoever.

Prognosis is not so bad as is generally estimated, for while a palsy certainly remains, it may be very slight and not disabling or seriously disfiguring. The more widely distributed the paralysis at first, the more serious is likely to be the damage. The severity of the onset is not a significant index, and those cases beginning most explosively recover surprisingly at times.

In the first few weeks little or no change may be expected, but if no improvement is noted in a muscle or group of muscles after two or three months, the outlook for improvement therein is gloomy.

If the palsy be ever so severe and yet respond fairly to electric contractions, much of betterment may be hoped for. When the response to faradism can with difficulty be elicited, the prognosis is poor; yet if this soon returns, hope again arises. If this reaction be long absent, the muscle is liable to remain permanently paralyzed; more probably so if the reaction of degeneration is present. Life is rarely endangered, and to this extent the outlook

is always good. If death occurs, it is in the earlier weeks. Moreover, the mind is rarely or never affected; no fear need be entertained of mental degeneration, which always threatens in the cerebral palsies.

Treatment.—Absolute rest and quiet are needed in the acute stage of this as of other inflammatory disorders, and the attention may be focused upon antipyresis and mild revulsives—the fewer medicines the better, except to meet symptoms, as fever mixtures—aconite, solution of ammonium acetate, with ammonium bromid or antipyrin. Salicylates may be useful for pain and muscular tenderness. Ergot is of value to limit the spread of inflammation. The bowels should be well opened by small doses of calomel, a saline, or castor oil.

After a time the damaged muscles demand treatment; gentle massage is early indicated in short seances after the limb is well warmed, superficial at first; later faradism strong enough to contract the muscles, cautiously, and finally galvanism.

Faradism is of use as a muscle tonic if the parts respond to it at all, to induce action which the will can no longer effect; if not, then galvanism must be used without delay. Frequent tests with faradism are useful to determine progress, and this it is always useful to employ along with galvanism whenever it produces contractions.

Massage, gradually increased, along with heat, is of undoubted value to aid nutrition, circulation, and reactive powers in muscle and skin; this overcomes tendency to contractures. Skilled manipulators are needed for this to secure any satisfactory results. Passive movements should be employed in all cases to prevent the constantly menacing contractures.

Chronic changes, contractures, and the like should receive the most careful attention from the orthopedist. Tenotomies are often followed by brilliant results. Splints, too, are of great assistance and must not be unduly delayed. Prevention of contraction is thoroughly feasible, and far better than the overcoming of it after deformity has become established.

ACUTE MYELITIS.

Myelitis is an inflammation of the substance of the spinal cord, characterized by disturbances in the motor, sensory, and trophic centers.

Causes.—Myelitis may occur as a complication of the acute infectious diseases, rheumatism, exposure to intense cold, or sudden changes of temperature when the subject is overheated

or exhausted, and to atmospheric conditions. It has been known to follow metallic and other chemic poisonings and overexertion; pressure of any kind, such as fractures and dislocations; and to arise secondarily to disease of bones of the spine, Pott's disease, and the infectious fevers, neoplasms, hemorrhage, and pachymeningitis. Very slight injuries in some instances seem able to cause severe myelitis.

Course.—The onset of myelitis, as a rule, is rapid, and total paraplegia is often established in a very few days. Complete recovery is rare. Cases may cease to progress after a fortnight or so, and never reach any serious condition of disablement.

Symptoms.—The symptoms of acute myelitis vary with the site of the lesion and intensity of the process, and the clinical features depend upon the amount of cord tissue involved. The two forms of myelitis which are common in children are those which are due to syphilis and to pressure or extension from Pott's disease of the spine; the temporary palsies of rickets and scurvy are similar. In the syphilitic form and those due to slowly developed pressure there may arise indefinite prodromes, such as slight disorders of sensation and intermittent weaknesses. A feeling of great weight in the legs may be experienced; in a few hours the legs may become quite useless, and in a few days entirely palsied. Convulsions and delirium have been seen, but are not common. Pain in the back and limbs may occur if the posterior nerve-roots are involved.

The upper limit of the lesion is often marked by a zone of hyperesthesia, or of a sensation as of a girdle drawn tightly about the body; and below this the paralysis can easily be detected. Lesions occurring in the cervical region involve the ciliospinal center, with consequent dilatation of the pupil. Complete transverse myelitis, at whatever level the area of inflammation may be, is exhibited by initial pains, numbness and tingling in the limbs, and within a few days disturbances of motion; the reflexes are altered, and if the lesion is in the lumbar region, control of the bladder and rectum is disturbed. Paraplegia is the characteristic form of paralysis.

In myelitis occurring in the cervical portion of the cord the paralysis of the upper extremities will be of a flaccid order; the paralysis of the lower extremities will be spastic in character. Anesthesia will be present in the four extremities and in the trunk to the level of the diseased segments; pupillary symptoms, unilateral blushing (due to lesion of the sympathetic), and paralysis of the diaphragm are present in some cases. "If the lesion is in the lumbar portion of the cord, the paralysis is restricted to

the lower extremities and will be of a flaccid character, with more or less atrophy. If the lesion is in the cervical or dorsal portion of the cord and the lumbar portion is entirely free from disease, the paraplegia of the lower extremities is of the spastic order; and the reason of this can be easily understood if we recall the fact that after a transverse lesion of any portion of the spinal cord the lateral columns will degenerate downward from that level, and that such degeneration of the lateral columns in the presence of normal gray matter of the lumbar segments will produce a spastic form of paralysis with rigidities and contractures" (Sachs).

Alterations of sensation are present from the start; areas of anesthesia will afford some clue to the situation of the lesion. At the upper limit of the area of lost sensation a zone of hyperesthesia may be found; above this, normal sensation appears. In other cases a girdle sensation marks the level between the normal and the diseased segments.

The state of the reflexes helps us also to determine the area involved. We quote from Sachs again: "If the lesion is in the cervical region, all the reflexes of the upper extremities are lost; those in parts below will be exaggerated. If the lesion is in the dorsal region, the reflexes connected with these segments, such as the abdominal and epigastric reflexes, will be lost and the lower reflexes will be increased. If the lesion is in the lumbar region, the knee-jerk will be lost and the ankle-clonus will be absent also. In some cases in which there is a very narrow band of inflammation these reflexes may behave differently and may give one a direct clue as to the exact extent of spinal inflammation."

It is common to find exaggerations of reflexes along with spastic contractures of the legs. For explanation of the phenomena of reflexes the reader is referred to the article at the beginning of this chapter. Electric reactions vary according to the segments involved. The reaction of degeneration will be found in most of the muscles of the upper extremities in cases of cervical lesion, while those in the lower extremities are unaltered. In lesions of the lumbar segments degenerative changes follow muscles supplied by nerves coming from the diseased area. In the muscles of the lower extremities the reaction is normal in cases of cervical and dorsal myelitis. The centers controlling the bladder and rectum are profoundly disturbed, resulting in retention of urine or overflow dribbling, and in retention or loss of control over the rectal sphincter. Priapism is sometimes an annoying symptom, as are also involuntary spasmodic twitchings, the latter resulting from very slight sensory impressions. A

slight touch may cause a large contraction of the entire limb. Bed-sores are formed from the very smallest causes, and must be assiduously guarded against in every way. Fever occurs in every form of acute myelitis, but may be complicated by other causes present. The most important point to determine is the cause. In the absence of other known origin slight traumata may be suspected; mere concussion may suffice. Those instances due to pressure, such as of tumors, tubercular deposits, syphilitic infection, and Pott's disease, are very distinct and have been alluded to.

Pathology.—It is exceedingly difficult to explain why the structure of the spinal cord should be so extremely liable to inflammatory disease, and why the dorsal portion should be more frequently attacked than the cervical or lumbar enlargements. The gross appearances, seen postmortem, show the cord to be surrounded by hyperemic meninges, and the cord itself congested or swollen. The cord substance may be softer than normal, or even reduced to a creamy pus, which flows out readily. There may be minute hemorrhages or red softening, and every degree of change between this and such a degree of extravasation of blood as obscures all other changes. Microscopically there may be seen dilated blood-vessels, with leukocytes, granules of myelin, corpora amylacea, and axis-cylinders in various stages of disintegration. Whether fibers that have once been seriously altered can ever recover is open to grave doubt, yet in a fair number of cases recovery is excellent. Conservative vicarious action of remaining normal fibers probably accounts for this functionation where part of the cord is destroyed.

Prognosis.—Naturally, the higher up the myelitis, the more is it likely to be dangerous to respiratory and cardiac centers. The perils in all cases arise chiefly from the complicating condition, particularly vasomotor disturbances and bladder and kidney involvement. If the myelitis is due to syphilis, a moderate toxic infection, or slight pressure from a curable Pott's disease, the possibilities for recovery are good. The lessening of anesthesia is a fair index of improvement, and deep bed-sores beginning early are almost a fatal sign.

Treatment.—The treatment for myelitis is much the same as that for meningitis; the main objects are to avoid complicating conditions and to relieve the diseased organs of all strain. The first requisite is absolute rest, on a water-bed if possible. The bowels should be purged, best by calomel, which also acts as a valuable diuretic. Some form of extension should be used from

the first; we have devised a very simple measure for this, consisting of a towel folded lengthwise to about three inches in width, and pinned with two safety-pins at the ends, making a ring large enough to just slip over the head; this adjusted under the chin and back of the head and caught on the two sides opposite each ear by a piece of bandage, forming a loop of, perhaps, two feet in length, extending to nearly the head of the bed, there to meet a piece of small rope and to hang over and down, and become attached to a weight, such as a flat-iron. This is a very simple device, and yet has again and again proved a very efficient one, and can be made by careful readjustment to act even better than an expensive apparatus. Counterextension, if required, is easily obtained by elevating the head of the bed. The diet should be chiefly of milk, soups, and other substances suited to inflammatory states, bearing in mind the vulnerability of the bladder. The water should be drawn by catheter, but excessive care should be used to avoid producing the ever imminent cystitis. Should this last occur, the bladder should be washed out two or three times a day with sterilized water or with boric acid solution. A very important point is to make sure that the nurse allows no wrinkling of the bed-linen on which the patient lies, who, no longer defended by acute cutaneous sensibility, and the vasomotor tone in the anesthetic areas being lost, easily suffers serious trouble to his skin. Should bed-sores begin to form, carefully adjusted antiseptic dressings should be used at once. Dusting-powders are here of use—acetanilid, thymol diiodid, aristol, and the like. When the urine dribbles away, instant care should be taken to catch it in some vessel, or, perhaps better, ample masses of borated absorbent cotton or antiseptic gauze. Medicines are of doubtful utility, except for symptomatic relief, such as digitalis, acetate of potash, urotropin, or other diuretics and diluents; the iodids are useful in syphilitic cases and may assist in eliminating inflammatory exudate; especially are the iodids useful in the subacute stages of the malady, and should at least be tried repeatedly, unless found disturbing to the digestion. Should these be unavailing, inunctions of mercury may be substituted with good effect. Electricity is of little use to the spinal cord, but is valuable for the paralyzed muscles. Massage may be tried more hopefully, and should be used just as early as is feasible. By this means preparations of oil may be rubbed in and thus aid nutrition daily. If involuntary contractions complicate the case, as is only too common, the person giving massage must use slow, firm strokings and gentle overextensions, which have a tendency to overcome this trouble. Strychnin must be used cautiously

and is not so safe a remedy as is generally thought. Immediately convalescence is well established, every effort should be made to secure as much fresh air as possible. This should be done quite early by using additional coverings, especially over the head, and opening wide the windows, which is the next best thing to getting outdoors. Of especial importance here, too, is tonic treatment for the skin, in the way of baths, hot and cold douches to the spine, adding salt to the water, aromatic vinegar, or the aromatic sulphuric acid, and following by oily inunctions. Counterirritation over the spine in prolonged mild cases of myelitis may greatly ease pain and exert some favorable influence on the inflammation.

DISSEMINATED SCLEROSIS.

Disseminated, insular, or cerebrospinal sclerosis is a disease of early life, characterized by a definite set of symptoms consisting of tremor, difficult, deliberate speech, ocular symptoms, and a peculiar gait, but with great variation in the phenomena. Anatomically, areas of sclerosis of varying sizes are found scattered through the brain and cord.

Causes.—Disseminated sclerosis in children occurs most often as a sequel of the infectious diseases, after traumata, overwhelming emotion, or possibly following metallic poisoning. It is more common in adolescents, and yet not rare in children. It is much more likely to arise in those of neurotic heredity, and is oftener met in Europe than in this country.

Symptoms.—The disease usually begins by a gradual weakness in the arms, fingers, and legs, with irregular pains and stiffness and an intention tremor, increased on effort, gradually increasing. This tremor subsides when the parts are at rest, becomes marked on exertion, and grows worse under coordinate acts and excitement. It often increases in intensity and extends to the legs, producing great difficulty in locomotion. The articulation becomes deliberate—"scanning speech," pronouncing each syllable slowly and laboriously, like a child reading from a primer. There may be a distinct vibratile quality of the voice. The tremor at times affects the muscles of the eye, producing a nystagmus which is increased by looking forcibly to right or left; the field of vision is narrowed, the color-fields altered, quite similar to the changes produced in hysteria. The tongue upon protrusion also exhibits a tremor, and the expression of the face becomes stupid and uncertain. The mental condition, especially memory, is impaired, and the sufferer is

exceedingly emotional, especially when the disease has begun early in life.

The paralysis is of the spastic order, showing in the gait a dragging, shuffling, springy motion of the legs (causing the shoes to wear through quickly in the toe part of the soles), due to rigidity and contractures. Athetosis is not uncommon. The deep reflexes are increased, and the muscles become rigid. These phenomena may remain much the same for a long period, and yet tend finally to grow worse. The memory weakens, speech becomes unintelligible, and finally all the voluntary activities fail; sensation is little affected; death usually occurs from some intercurrent disease.

Pathology.—In disseminated sclerosis there are found plaques of sclerotic tissue distributed irregularly throughout the greater part of the central nervous system. These patches of firm gray tissue appear in the brain as well as in the spinal cord, and may appear first in the one or the other. Whether the hardening shows in the nervous centers or in the fibers emerging from them, the character of the changes is much the same, the important point to keep in view being that only some, and not the majority, of the nerve-fibers are destroyed, thus producing a perverted action of the whole cerebrospinal system.

Prognosis.—Multiple sclerosis is a chronic disorder, and induces death more by depreciating the entire organism and by adding an element of peril through increasing susceptibility to disease than by itself terminating life. If the vital centers are affected, death may be caused by this process directly. The progress is slow and quite incurable, but may in some instances come to a standstill for years. We have had under observation a family of many children in which three, and possibly four, are affected by this disease, and from a very early age. One of these, a boy, served us in the capacity of errand boy for some months. They are all still living, though the oldest sufferer, aged about twenty-three, is now bedridden.

Treatment.—The disease is quite incurable, but many measures are of distinct value in enhancing the comfort of the sufferers. Prolonged rest, with systematic hygienic measures, benefits exceedingly. The process is very exhausting to the victims. There is a perpetual unrest, which needs to be met by unremitting reparative measures. Sleep is oftentimes much disturbed, and tepid baths at night contribute largely toward general contentment. Cool and colder douches are useful during the day, or the drip sheet, the patient standing in warm water. Electricity is of little use to the muscles—the constant current is valuable

applied to the spine. Mild galvanism moved up and down the back may be tried most hopefully. Manipulations of the limbs will do much toward relieving the contractures. It should be borne in mind that in giving massage to spastic limbs, slow, firm movements are best; also, as demonstrated long ago by Mitchell, overextensions of the limbs tend to overcome contracture, lessen tremor, and make the parts more elastic.

Medicinal.—Iodids and mercury have not the slightest effect, but arsenic is recommended, and a prolonged course of nitrate of silver may be tried. For the tremors, bromids, hyoscin, hyoscyamin, gelsemium, cannabis indica, and belladonna exert some relief.

If contractures become extreme, and especially if they impede locomotion by malposition of the feet, tenotomy may greatly aid in getting the patient to move about with more freedom and ease.

HEREDITARY ATAXIA.

Hereditary ataxia, known also as Friedreich's disease, is a form of spinal hardening appearing usually in children, and with distinct hereditary features. It is to be recognized by a wide-spread ataxia, beginning in the legs, by impairment of speech, and by nystagmus. The course pursued is a progressive one. There are many symptoms which, while sometimes absent, yet assist in giving a definiteness to the diagnosis. The cause is a very striking one of hereditary transmission during several generations. This may be in the same form, or by analogous scleroneurotic diseases. The susceptibility increases in the later generations, and those attacked are progressively younger. The defective development is rendered conspicuous by this—showing or seeming to show that portions of the nervous system, especially the spinal cord, are incapable of sustaining their normal action and undergoing sclerotic change. Sometimes it is transmitted more from one sex than the other in one family, but in the next instance the reverse appears; the histologic changes in the spinal cord are pretty much the same as those which occur in locomotor ataxia.

The **symptoms** are those of profound awkwardness, with a tendency to fall upon slight provocation. The knee-jerk is lost very early, as a rule; in certain cases, however, this is increased. The superficial reflexes are present or absent about equally. Sexual power is lost soon or late, hence descent in the male line is rarer. Romberg's symptom (standing unsteady or swaying with the eyes closed) is usually present, and more marked

by an exaggerated sway or total inability to stand, and this progresses steadily; after a time the upper limbs and neck become involved, rendering the patient helpless and losing control of the head. Speech is likewise modified by the loss of all muscular power. Nystagmus is usually present, although not constantly, and must be watched for. There is little or none of the sensory disturbances seen in locomotor ataxia. The power of the muscles is much reduced, but actual paralysis comes on very late and is of only moderate extent. Sometimes coarse tremor is present, amounting to choreoid movements of the head and legs. The face has a somewhat characteristic expression, is stolid, heavy, with dropped jaw and mouth partly open. The course of the disease is chronic, death resulting from intercurrent maladies. Some cases have lived to a considerable old age, and others have been discovered only in their later years.

The **diagnosis** is made upon the youthfulness of the patient, slowness of the onset, the family history showing similar cases or instances of spinal sclerosis and predementia or direct features of the ataxia—nystagmus, peculiar halting speech, and, to a certain extent, facial expression. The pains of locomotor ataxia are absent, also the peculiar pupillary symptoms of that disease.

The **treatment** is altogether unsatisfactory. Those measures recommended in locomotor ataxia may be used, and general tonic and nutritional measures are demanded. Above all, much solicitude should be exercised to afford a reasonable amount of instruction, so that these unfortunate beings should possess some source of amusement or occupation through their long and miserable existence.

PROGRESSIVE MUSCULAR ATROPHIES.

An interesting group of disorders is that of the muscular atrophies. Some of these are peculiar to childhood and less rare than has been for a long time believed. The important point to make clear in each case is whether it is due to spinal origin or is simply a muscular degeneration. The muscular atrophies of spinal origin are called *amyotrophics;* those of muscular origin, *myopathies.* The term *dystrophy* has been restricted to primary muscular wasting.

PSEUDOHYPERTROPHIC MUSCULAR PARALYSIS.

This myopathy is a disease of early childhood, characterized by progressive loss of power in certain muscles and groups of muscles, which increase in size and yet are actually weak. Atrophy of the affected muscles finally supervenes.

The general **symptoms** are those of clumsiness and increase in the size of the muscles affected, the child falling readily and getting upon its feet with great difficulty. The muscles of the lower limbs are those chiefly affected, but certain muscles of the arms are also involved at times, those of the hand and forearm especially. The attitude is very characteristic: the legs are always held wide apart and the trunk is very erect, with the back usually hollow, amounting often to a lordosis. The gait is a slow, wide-sprawling action, the feet being put down with great deliberation and the balance laboriously maintained. One of the most characteristic signs of the diseased condition is the manœuvers executed by the child in rising from the floor and getting upon its feet. This is as follows: The child, lying upon its back, rolls over on its side with more or less difficulty, and having straightened out its hands and feet in the position of "all fours," commences with great straining action to struggle finally to a position in which the knees are extended; then, watching its opportunity, it seizes one of its knees with the corresponding hand, throwing the head back, and catching the other knee with its corresponding hand, and then straightening the body.

The tendon-jerks, as a rule, are unaltered, except that they exhibit a greater feebleness and are finally lost. Sensation is impaired, also the mental activity, as a rule. There are often slight vasomotor disturbances, shown by a mottling of the skin of the legs. The cause of the malady is admitted to be hereditary influence in most instances, and always through the mother, who herself may show no evidence of the disease but transmits this developmental defect. While recognized after puberty has set in, it is reasonable to assume that the disease was in evidence before that time.

Pseudomuscular hypertrophic paralysis is now generally conceded to be primarily a disease of the muscles, an idiopathic myopathy.

The **pathology** of the disease is obscure—a degenerative change in the muscular tissue itself, a trophoneurosis. Along with this, or following soon after, is a change in the connective tissue, which is both infiltrated with fat and increased in bulk, and to this is attributed much of the hardness of the muscles.

The **diagnosis** of this condition is not at all difficult when once the overdeveloped muscles become well marked. If this phenomenon has not become conspicuous, the peculiar attitudes in lying and rising will give pretty complete evidence of the disease, whose main features depend upon the weakening of the muscles involved in those acts. It is well described, in brief, as a slow and tedious climbing up the legs. Chronic neuritis is accompanied by fibrillary contractions and the reaction of degeneration, both of which are absent in this disease. It seems scarcely possible that spastic paraplegia could be confused with pseudomuscular hypertrophic paralysis, and yet this has occurred. In the spastic condition the strength of the muscles, usually with wasting and great exaggeration of knee-jerk and the presence of ankle-clonus, makes a conspicuous contrast.

The **prognosis** is altogether unfavorable, but those who are cared for best will live the longest.

Treatment is merely symptomatic and tonic. Systematic massage continued for many months has markedly improved several cases under our observation. Electricity is of less service.

CHAPTER XV.

THE SPECIFIC INFECTIOUS DISEASES.

TUBERCULOSIS.

Tuberculosis is a specific infectious disease due to the presence in the system of the bacillus tuberculosis, discovered by Koch in 1882. It is characterized by the formation of small nodular bodies around an irritated point, the center of which is the tubercle bacillus. The process is the product of a local inflammation, and may be acute or chronic, resulting in specific toxins, causing an irregular febrile movement and the formation of new and easily degenerated tissue, called tubercle, which may become so much further weakened as to be described as caseous. It is met with in nearly all parts of the globe, and is more destructive to human life than any other one disease, "causing about 14 per cent. of all deaths—more than the aggregate from all the commoner infectious diseases, including Asiatic cholera and leprosy." Tuberculosis is now almost universally regarded as contagious, infectious, or both, and prevails not only in man, but in many animals, and may be acquired by inheritance, inhalation, swallowing, and by inoculation. The contagion of tuberculosis is of a slow and insidious kind, and there must be a suitable ground for its growth and a fairly large amount of the morbid material for it to grow upon. While to other contagious and infectious disorders there may come an acquired immunity, there is a tendency in tuberculosis, when begun, to steadily and rapidly progress. The presence of the bacillus tuberculosis in whatsoever secretion or tissue of the body is an infallible indication of infection by the disease, and there is practically no limitation to its extension. Infection does not necessarily mean the establishment of a progressive and fatal disease. In many cases a natural and spontaneous cure is effected, when favorable conditions for the development of the disease are not present nor continuously maintained. There may also occur spontaneous arrest, even after the symptoms have declared themselves, the process becoming quiescent under favorable circumstances. It is prob-

ably not so prevalent or so deadly among children in this country as in Europe.

Causes.—The direct and exciting cause of tuberculosis is the tubercle bacillus of Koch, which gains entrance into the system —(1) by direct transmission (parental); (2) by inhalations, dried sputum floating in the air, dust being a collateral medium of contagion; (3) through infected milk and meat of tubercular cows and food animals; (4) through kissing, especially where the practice prevails widely between families and friends.

Tuberculosis may be congenital. Lehman reports a case in which the tuberculous mother died, three days after the birth of her child, of tuberculous meningitis, the child living but twenty-four hours. In its spleen, lungs, and liver were found nodules resembling tubercles and containing tubercle bacilli in large numbers. Birch-Hirchfield reports a similar case.

Tuberculosis is extremely rare in the new-born and uncommon in the first three months of life, increasing in frequency toward the end of the first and during the second year. It is often met from the third to the fifteenth year. Among children its seat is more commonly in the bronchial glands, lymph-nodes, lungs, and bones; it is also found in the pleura, brain, stomach, intestines, the large viscera, heart, and skin.

Certain individuals among animals and men are more susceptible to tubercular poison than others. This susceptibility may be inherent or acquired. Some races of both animals and men exhibit a marked predisposition to this disease, which among these individuals is propagated with great readiness and develops with extreme virulence. Among races and families in whom there may be no general predisposition there are occasionally seen individuals who are distinctly more receptive or less capable of resisting the infection than others; and since the time of Hippocrates people of a certain type of body, as described by him, are believed to be prone to tuberculous disorders. This is especially true among children in whom classic types of conformation are recognized, as the "tuberculous" with thin skins, long, slender bones, light hair, bright eyes, and oval faces; and the "scrofulous," with chunky figures, dense, muddy skins, thick lips, heavy features, and large bones. Certain organic defects seem to render their possessors more susceptible, such as a contracted thorax, with limited respiratory capacity, small and feeble hearts, narrow arteries, and relatively large-sized viscera. Certain local conditions in children are potent predisposing causes, such as catarrhal conditions of the throat and upper air-passages; also, dilatation of the bronchi and existing pleurisy, disease

of the stomach and intestines, especially where there is long-standing enterocolitis. Tuberculosis in children is especially liable to follow the infectious diseases, particularly measles, whooping-cough, and influenza. Various depressing causes lower the resistance of the individual to this poison, among which syphilis, typhoid fever, and smallpox are prominent; also chlorosis and anemia, along with unhygienic environment, nutritional depravity, and inherited vulnerability of tissues.

Hereditary predisposition has long been regarded as a pow-

FIG. 39.—TUBERCULOSIS OF THE LUNGS DEVELOPED DURING TYPHOID FEVER.

erful factor in the transmission of tuberculosis. It may be regarded as a varying constitutional quality, a "type of tissue soil" which favors the development of the disease provided accidental infection occurs. Others argue against this belief, asserting, on the other hand, that an immunity may be thus transmitted. The long incubation period, of thirty days or more, under most favorable conditions, and the fact that the infective agent may lie dormant for months or years in the tissues which have a meager blood supply, and later, under

suitable conditions, becoming vigorously active, and the peculiar phenomena which are finally exhibited in certain families, make a ground for conjectural rather than scientific conclusions. Congenital tuberculosis is very rare, and in all the reported cases is directly maternal, no evidence being adduced that a tuberculous father can directly transmit the disease. The children of tuberculous parents most frequently exhibit the disease, but are thus constantly and intimately exposed to infection. Wherever the individuals are restricted in the matter of fresh air, sunlight, and exercise, there is greater prevalence of tuberculosis. Local epidemics of this disease occur in all communities. In Philadelphia, in certain wards of the city, it is shown to be particularly prevalent, especially in previously infected or badly situated houses (Flick). The air breathed out by tuberculous patients is considered harmless, but a large danger exists in their sputum, dried and pulverized and scattered about. Food is a common but perhaps exaggerated means of tuberculous infection, especially the milk of tuberculous cows, rendering it absolutely essential that systematic sanitary inspection of all animal foods should be rigid and constant. It is not certain whether the milk of a tuberculous woman is virulent or not; happily the mere swallowing of tuberculous milk, cream, butter, or meat is only a relative danger, other conditions being necessary for infection, whether local traumatisms or merely a marked susceptibility. Certain general conditions strongly influence infection, especially environment. The disease prevails in crowded centers, where contact among individuals is more direct, along with many devitalizing influences, among which severe or prolonged nervous strains are important, and restricted opportunities for movement and change. The situation of the house, the common living-rooms, the soil, cold and dampness, elevation, and the like, are potent factors in tuberculous propagation or resistance. In infancy infection is demonstrated to be through the respiratory tract, shown by the common distribution of the primary lesions. Infection through the alimentary tract is much less certain or frequent. A meat diet is much more generally used in the latter half of the century than the first, yet tuberculosis is shown to be now far less prevalent than then. Tabes mesenterica, which is the chief manifestation of tuberculosis in infancy, has not lessened during the epoch of improved sanitation, which is also marked by the increased consumption of milk as an infant food. In both the respiratory and the gastro-intestinal tract some lesion of the mucous surfaces is necessary for the ready acceptance of the poison. Even then the bacillus, when lodged in the adjacent

lymph-nodes, may there remain inert. Treves and Holt maintain that tuberculosis of the cervical lymph-nodes is rarely a source of further extension of the disease, though Jacobi makes much of the latent danger of spread from this source. Inflammation and acute febrile conditions may, however, stir up this dormant infection and cause wide-spread disease.

GENERAL TUBERCULOSIS.

Tubercular infection is oftentimes most puzzling in its onset and course, giving a wide variety of symptoms, at first vague and ill defined, and only later, and not then always, showing distinct evidence of localized disease. Each case gives rise to some peculiar features, depending upon the avenue and direction of the infection, the degree of resistance in the tissues, constitutional peculiarities, and the like. The general febrile process thus masks the local disturbance, which may escape recognition altogether or be only shown postmortem.

In infants the symptoms are often merely those of a general wasting—a marasmus; the subjects are pale, thin, slowly losing weight, and finally dying of exhaustion. As a rule, there will be recognized a fever, possibly much higher than suspected when the thermometer is used, but seldom regular in course or above 100° or 101° F. (37.7° to 38.3° C.). Slight pulmonary signs appear toward the end, not well marked or in themselves significant; or these may become pronounced, especially dyspnea and cough. Again, the symptoms point toward lesions of the digestive tract, vomiting, and diarrhea; and these may be due to the constitutional disturbance rather than local infections of the organs disturbed. The diagnosis in babies under a year old can only be made by the course of the disease and the knowledge of a probable tubercular infection, exposure to older folks who suffer from the malady, inheritance, or adequate inference from collateral conditions, infected food, etc. In older children the symptoms are those of a continued fever, with protracted and indefinite symptoms, each one insignificant, but collectively convincing. The subjects are generally feeble, ill developed, hypersensitive, lacking in vigor, and liable to catarrhal or dyspeptic disturbances. Typhoid fever is closely simulated, barring the characteristic spots and splenic enlargement. Always there are the wasting and cachexia; often there are meningeal symptoms.

TUBERCULOSIS OF THE LUNGS.

The lungs and bronchi are most commonly affected by tubercular processes, producing pretty much all varieties of pulmonary disease. The subjects to be now considered are those states of tubercular involvement where the most conspicuous disturbances are observed in the lungs, producing the clinical features of an acute or chronic pulmonary disease. Two groups of cases may be separated: the rapidly destructive process, acute tuberculous bronchopneumonia, and a slower chronic form, accompanied by ulceration, called chronic pulmonary tuberculosis.

Acute Tuberculous Bronchopneumonia.

Acute tuberculous bronchopneumonia is common in children from the sixth month to the fifth year, and is the characteristic and most frequent form of tuberculosis in early life. It is peculiarly liable to follow the acute infectious diseases, especially measles and whooping-cough. It is also often a consequence of whatever conditions, acute or protracted, have profoundly lowered the general health. Inflammatory disturbances about the upper air-passages and active catarrhal or obstructive troubles seem to predispose markedly to the development of tuberculosis, and it may be the terminal process in persons affected by local tuberculous trouble elsewhere. The pleura is usually involved also; occasionally there results empyema. Both lungs are involved, as a rule, in different degrees. The upper lobe of the lung is oftener affected than the lower, and especially that part near the root, in the region of the bronchial glands.

Morbid Anatomy.—The essential lesion at first is bronchitis. The tubercle bacilli, lodged in the terminal bronchioles, excite a proliferation of the fixed cells, accompanied by the production of epithelioid and giant cells, which frequently contain the bacilli. This epithelioid element acts as an irritant, becomes surrounded by leukocytes, chiefly polynuclear, forming a translucent gray mass, the tubercle of Laennec. At the margin of the tubercle a network of fibers is formed from the connective-tissue matrix. The tubercle undergoes changes which are in the nature of caseation and necrosis, with the presence of the specific bacilli and others (Prudden), as the streptococcus and staphylococcus.

Caseation.—The bacilli excite a coagulation-necrosis, beginning in the center of the tubercle and spreading to the periphery, convert the tubercle into the yellow, cheesy mass so common in

tuberculosis. At this stage the mass may undergo—(1) softening, (2) encapsulation, (3) calcification, or (4) sclerosis. In the first the softened mass may break into a bronchial tube and become expectorated, leaving behind an excavation with ulcerating surfaces; or, (2) being encapsulated by the overgrowth of connective tissue, undergo (3) calcification, or (4) necrosis with increased growth of fibrous elements, ultimately ending in the conversion of the tubercle to a hard, firm structure. In some instances a simple bronchopneumonia precedes the tuberculosis; especially is this true where the disturbance follows upon measles, whooping-cough, or other infectious diseases.

"In cases of tuberculosis consecutive to bronchial pneumonia we find the lesions of two sorts: Simple inflammatory non-tuberculous, such as peribronchial suppuration, dilatation of the bronchi, lesions of the alveolar epithelium, and peribronchial and perialveolar sclerosis; then, in addition, there are the true tubercular processes, peribronchial nodules, tubercular infiltration, and caseous areas" (Mosny, quoted by Osler).

Again, sometimes the tuberculosis is established before the bronchial pneumonia sets in, especially where tuberculosis is latent in the individual, and a bronchial pneumonia arises from whatsoever cause. "This is," again to quote from Mosny, "a bronchopneumonia dependent upon pneumococci or streptococci, invading the lung already the seat of local tuberculosis." Once the process of softening is established in children, it usually progresses until the life of the patient ceases. The bronchial lymph-nodes in such cases will be found tuberculous, and a chain of these may be seen to lie along the greater bronchi. Periods of arrest occur, with subsidence of the physical signs, cell-organization proceeding to produce fibrous walls, acting as barriers to the advancing process.

Symptoms.—There is little or nothing in the earlier stages of tubercular bronchopneumonia to distinguish it from the simple form: the physical signs are the same. The disturbances of the apex are of no importance as a distinguishing feature, because in children the tubercular process may begin at the base or center, and the closest examination of the lungs may reveal little or nothing characteristic. The most valuable indication of the special nature of the trouble is in the course and progress of the disease, which exhibits great irregularity in the temperature-range and marked evidences of rapid loss of strength. All this is far more significant in a little child than in an older person, in whom several factors combine to form such a picture. Emaciation soon becomes conspicuous, sweats, oftentimes profuse, accompany, and

the gravity of the disorder becomes obvious from many things, producing a suggestive syndrome. Cough may or may not be present.

In protracted tubercular bronchopneumonia the signs of consolidation manifest themselves, involving, it may be, the whole lobe. This proceeds to casecation, softening, and cavity formation. In the acute cases the duration is about a month. It is rarely possible in children under seven to secure expectorated matter in which to exhibit the bacilli; and yet it is a constant matter for surprise how extensive tubercular disease may be present with little or nothing in the physical signs to evidence the fact. Cavities can rarely be demonstrated, though small ones having ragged or irregular walls commonly exist.

Chronic Pulmonary Tuberculosis.

In very young children tuberculosis shows itself in the lungs as a wide-spread generalized process, involving other organs as well, or as a bronchopneumonia. In older children of seven or eight or more it resembles the chronic tuberculosis of adults. The lesions in children are much the same as those in adults—miliary tubercles, peribronchial nodules, caseous masses, areas of softening and of fibroid thickening, and cavities of various sizes. The parts attacked first are not necessarily near the apex, as in adults, but may be at the base or center. The disease spreads directly from the deeply seated glands, either in the lung itself or along the trachea and about the bronchi. Occasionally considerable areas of caseous pneumonia are found; small cavities are often met, but large ones very rarely. A tubercular bronchial pneumonia frequently gives origin, through the disturbance of the smaller bronchioles, to a peribronchial alveolitis. There are also seen caseous masses, gray tubercles, infiltrations, dense fibroid thickenings, and irregular cavities near the roots of the lungs; one or both bases become semisolid from caseating pneumonia, or similar states arise at the apex. The pleura are likewise affected, producing empyema, etc. The liver, kidneys, and spleen exhibit caseous masses, as do also the mesenteric glands, and ulcerations form in the intestines. Tubercles are found in the peritoneum and meninges of the brain.

Symptoms.—As in the adult, the general features of oncoming pulmonary tuberculosis in a child are those of marked pallor, gastric disturbance, loss of flesh, and steadily failing health. The phenomena are far less clear and distinctive in

children. Along with this is loss of appetite, rarely extreme. Slight chilliness may indicate fever, and malaria or typhoid fever may be suspected. Some cases follow upon recurring bronchitis along with nasopharyngeal catarrh. There is nearly always a hacking cough, at first dry and short, by and by looser, usually in the morning, sometimes with more or less sputum, occurring during the day or at night, and occasionally paroxysmal, like whooping-cough. Young children do not expectorate; yet if over eight or ten years of age they may do so, and the sputum is merely mucoid at first, and in the later stages it becomes purulent. Hemoptysis is rare in children. Fever is always recognizable; this, along with progressive feebleness, acceleration of pulse, and a slight, regularly recurring cough, should always excite solicitude. The fever itself in the earlier stages is remittent, ranging between 102° and 104° F. (38.8° to 40° C.). When the disease grows more extensive, the temperature has the quality of becoming hectic—in the morning normal or subnormal, while in the evening it may reach 104° or 105° F. (40° to 40.5° C.). Chills are rare, but toward the close profuse sweats are common. Difficulty of breathing may be present from the first, due in part to the fever or to extensive bronchitis. In other cases, as in grown people, there may be little or no dyspnea and yet a wide-spread destruction of the lung tissue exist. Tenderness on percussion over the affected areas is often observed in children. The digestive organs are frequently involved, and not seldom a persistent diarrhea indicates tuberculous intestinal ulceration. Albuminuria is more or less common in the later stages. General anasarca in a child should suggest tubercular complications involving the internal organs.

Physical Signs.—*Inspection.*—The chest is usually long and flat; the affected side may show limited movements, with prominence of the clavicle, or in chronic cases flattening with depression of the shoulder. On *palpation* there may be discovered limited expansion and increased vocal fremitus. *Percussion.*—There is little or no change in the percussion-note in the earlier conditions, except, perhaps, if one apex is considerably involved; then there is dullness above and below the clavicle; supraspinous fossal flatness is rare. The cracked-pot sound is of no value in children. *Auscultation* may exhibit the various sounds of bronchial catarrh, alteration in respiratory sounds, and rales, moist and piping. The sounds heard in the chest are by no means reliable guides as to the really grave features. The shallowness of the infantile chest makes it most difficult to estimate fairly differences in resonance. In children the course of chronic

tuberculosis of the lungs is much more rapid than in adults, and they rarely survive longer than a year. Occasional phases of improvement may be seen, along with periods of high fever and rapid loss of strength. In rare instances chronic tubercular changes merge into fibroid conditions, and a fair measure of health may be regained, enabling the child to live a number of years. Club-fingers are exhibited under these conditions, a sign merely of chronic degenerative change. Suspicion of tuberculosis should always be aroused whenever progressive emaciation takes place in a child with cough and hectic fever. Tuberculous bronchopneumonia is the condition found early, but the progressive character of the lesion may often be traced. Every effort should be made to secure some portion of sputum, which will help to clear up the diagnosis. The recovery from tuberculous states in children is comparatively rare if once hectic fever is established. Tuberculosis may attack the pleura, usually secondarily to existing disease in the lung. The pericardium is also occasionally involved; this is usually associated with tuberculosis of the mediastinal and bronchial glands. The kidneys and intestines also are not seldom found infected, producing albuminuria and disorders of digestion, persistent and recurrent.

Diagnosis.—Hectic fever, dry cough, persistent catarrh of the respiratory tract, diarrhea, emaciation, and evidences of consolidation are probable signs of chronic tuberculosis of the lungs. The discovery of bacilli in the sputum is the only positive diagnostic sign of the disease. Trudeau condemns the waiting for marked physical signs or a clinical picture, and urges the use of the tuberculin test, which he declares, is the most searching and delicate means of detecting early tubercular disease. It is not dangerous in incipient cases, and no harm results from small graded doses at two or three varying intervals.

Prognosis.—The ultimate outlook is distinctly unfavorable, though the disease is not incurable. A family history of consumption adds much to the gravity of the outlook, showing a lessened power of resistance to the toxins. When cases are seen early and placed under proper treatment, recovery may take place. Prognosis is bad when hectic is established, appetite poor, and the stomach of defective competency.

Treatment.—*Preventive.*—Knowing that tuberculosis is an infectious disease and that children are exceedingly susceptible, prophylactic measures should be instituted, and their observance insisted on both by the patients and by the members of the household. The consumptive adult who comes in contact with children should not spit promiscuously about the house,

or in the cars or public conveyances. Sputa of consumptives should be received in a suitable vessel, containing antiseptic solution, and afterward destroyed. Pieces of linen can be used for this purpose and subsequently burned. The healthy should not sleep in rooms occupied by those suffering from this malady. Kissing is to be positively prohibited. Cattle should be rigidly inspected, and all meat and milk of tubercular cows declared unmarketable. A consumptive mother should not nurse her child.

The treatment of all varieties of tuberculosis in man resolves itself into one plain proposition, and that is the maintenance of nutritive vigor. Along with this is the whole question of the powers of resistance or immunity which may be natural or acquired. Whatever makes for resisting power makes for recovery. Drugs which are useful in reinforcing the powers of resistance for the patient by regulating and maintaining the activities of the various bodily organs are strychnin, digitalis, animal and vegetable digestive ferments, mercury, nitroglycerin, mineral and fruit acids, vegetable tonics, iron, bismuth, charcoal, and diffusible stimulants.

Strychnin is a most valuable remedy. It probably acts by overcoming in some way the inhibition which the irritated nerve-ends of the vagus exercise upon nutritional processes. Digitalis is a useful remedy in the treatment of tuberculosis, but it should be used only when there is positive indication for it. Incompetence in the circulatory system, whether in the blood-vessels or in the heart, calls for digitalis or some of its derivatives.

The diffusible stimulants are of great efficacy in emergencies, such as depressed states of the nervous system or circulation. Aromatic ammonia used freely will do much good; also good brandy or whisky or the old, heavy-bodied wines, as port and Madeira.

Of the drugs which aid immunity directly, iodin is rated the highest by some. Flick prefers europhen and olive oil by inunction, and claims that iodin used in this way is practically a specific in early phthisis. To aid glandular activities the mercury salts are of much utility. In states of biliousness a well-directed dose of calomel, ipecac, and rhubarb will help back upon a plane of vigor what seem oftentimes alarming conditions of depression, physical and mental. For hemoptysis nitroglycerin is the main reliance.

It is a happy circumstance that this most wide-spread and prevalent disease is sometimes spontaneously, and oftentimes entirely, to be checked by suitable measures adapted to each

case. The measures to be employed are, first, to live in the purest possible air and become inured to the changes of the weather; to get as much as possible of dry air and sunshine. The next thing is to secure perfectly good, abundant, and well-prepared food, and to digest and assimilate it. The staple diet should be nitrogen and fat. The starch foods are highly important, and if not well tolerated, they give trouble. The use of diastatic ferments will relieve this. Lastly, there is a series of nutrient tonics which have enjoyed the confidence of medical men since the earliest ages, at the head of which list stands cod-liver oil, to be taken one-half to three-quarters of an hour after meals, or when and how proves best suited to the stomach.

Special treatment for the tubercular process has never been crowned with any very remarkable success. The brilliant possibilities of Koch's tuberculin have never yet been realized, but hope along those lines has never been altogether abandoned. Internally creasote, and its derivative guaiacol, now enjoy the confidence of the medical faculty. From its use excellent results have been obtained. The use of nucleins, too, by reinforcing leukocytosis, holds out glittering promises. There are many preparations most helpful, of which phospho-albumin is a type and the one which has given us the most satisfaction.

The influence of creasote seems to be that of a general nutritive stimulant, lessening the fever, promoting tissue elaboration and digestive vigor, and in other ways, not clearly shown, producing favorable results. It seems in some way to combat the toxins of mixed infections, in which pus-producing germs take part, and which constitute perhaps the most serious condition into which a tuberculous patient can fall. This is manifested by chills, fever, sweats, distressing cough, and profuse expectoration. Creasote in large, well-sustained doses will greatly reduce suffering and aid recovery. The dose for a young child is from ½ to one minim, steadily increased to as much as it will bear, the index of endurance being the tolerance of the stomach. A convenient method is to put creasote in capsules or pearls, which children can readily be taught to swallow, or mix it with some simple elixir, of which the very agreeable fluid preparations of pepsin and pancreatin now on the market serve as excellent menstrua.*

* Flick states that the best way to administer creasote is in large drafts of hot water some time before meals. For children who refuse this highly aromatic offensive substance there are combinations almost tasteless which have served us well, as benzosol, etc. The beneficial effect of creasote may be due (1) to a bactericidal effect of creasote against the bacilli which are associated with the tubercle bacillus—streptococci,

It is usefully administered in the form of an inhalation. Guaiacol is well tolerated dropped on a lump of sugar or into an elixir. None of these highly volatile substances should be made up in a mixture of a perishable nature and allowed to stand. They are better dropped into the menstruum immediately before using. Hypodermically, guaiacol is used along with sterilized olive oil in a 5 per cent. solution. Other balsamic substances have been used by various authorities with good effect.

It is an exceedingly nice point to choose a suitable climate for the sufferers from the more active forms of tuberculosis, and while the more distant resorts difficult of access enjoy the most classic reputations, nevertheless there are places comparatively near by each one's home where the local conditions are all that are actually needed, provided great care is exercised in the selection of the house site. For instance, there are to be found near most of our cities sheltered valleys, especially upon hillsides looking to the south, surrounded preferably or fringed by evergreens, where a close observer will note a quality in the growing plants which testifies to salubrity. The building of a little cabin here will oftentimes afford very nearly all the advantages to be had in remote and well-known health resorts, with few of their disadvantages. It is not necessary, nor is it even desirable, for children to be dragged to the ends of the earth, at great expense and infinite trouble and sacrifices on the part of their parents, when all the essential conditions can be partly found and partly provided at small expense and under intelligent guidance be procured somewhere near their homes. The one thing essential to those predisposed to tuberculosis is a life in the open air during the best part of their waking hours. The needful conditions can be found in an acre or less of ground through which they can range and play at will. In suitable weather they may venture further abroad and thus enjoy a needful variety. The treatment of more acute tubercular conditions, as where fever has set in, can be accomplished far better within easy reach of home than in the more remote health resorts. Here the open air is most essential, also, with opportunities for swift retreat to a solarium, or a large, well-warmed room, when the weather changes. The fever itself is most obstinate and serious. Local cold, as by sponging, is

---

pneumobacilli, etc.; (2) stimulation of the metabolism, which increases and strengthens phagocytosis; (3) a chemic effect of the phenol group, which leads to a neutralization of the toxins. The chemic action of creasote increases with the quantity. Creasote is to be used only in noncachectic tuberculous patients, in the first and second stages (Savoire).

the best means of reducing this, as it serves the additional purpose of acting as a powerful vasomotor tonic.

Among the mixed infections the most serious are the pus-producing germs, with the phenomena of fever, sweats, and distressing cough. For this the great remedy is creasote, in full increasing systematic doses. For hectic and sweating, astringents to the skin—aromatic vinegar or aromatic sulphuric acid is useful applied upon the surface. Internally this last may be given along with nux vomica. Picrotoxin checks sweating admirably in small doses, gradually increased; so does the hydrobromate of hyoscin. Agaricin and zinc oxid in pill form have been highly recommended to check sweating. For the relief of cough the various preparations of opium have never yet been surpassed. The old-fashioned paregoric is here still supreme, or McMunn's elixir or the derivatives of opium, especially codein or morphin. External applications are oftentimes most comforting: occasionally poultices, for their heat and moisture, or medicated in various ways—the addition of laudanum or a poultice made of hops. Tubercular diarrhea is a serious symptom, requiring the prompt use of astringents, as lead, tannin, gallic acid, sulphuric acid, and the like. Various aids to digestion are usually indicated, the mineral acids, the vegetable bitters, pepsin, pancreatin, caroid, peptenzyme, protonuclein, or the compound nucleins; the syrup of phospho-albumin is of great value. A well-prepared form of cod-liver oil, if it is made from the fresh livers and is free from rancidity, such as Stone's Cod Oil, is a great help in many forms of nutritional disturbance. This may be given in capsule, small amounts of a good article sufficing; or a sound oil may be put in the form of an emulsion at home, with a fresh raw egg and a small quantity of glycerin or honey, with the addition, it may be, of Jamaica rum or other spirits, the whole shaken together in a stone or amber-tinted bottle to defend it from the light, and used up in a few days.

In dealing with tubercular conditions prevention is much the most important part of treatment; this involves not only preventing the sources of contamination reaching the individuals, which is to be done by zealously guarding them from all sources of infection, but whenever tubercular glands are recognized, these should be promptly and thoroughly removed by a surgeon. In children so predisposed the utmost pains should be taken to rear them hygienically, and particularly to guard against and cure all catarrhal affections. The children should be especially encouraged to take and assimilate fat, and be guarded during their convalescence from contagious diseases.

TYPHOID FEVER.

Synonym.—ENTERIC FEVER.

Typhoid or enteric fever is an acute infectious disease due to a specific bacillus (Eberth). In children it is in most essential respects similar to the same disease in adults, although in some clinical features there are differences which must be considered. Moreover, typhoid fever in recent years differs in many particulars from those forms observed and described in the past. For a long time it was thought that infants and young children were immune to this disease; but although rarely, yet we do find it occurring in children only a few months old, but in these instances it is almost inevitably acquired from a nursing mother who is herself infected. We have, ourselves, recorded cases of this disease in babies of five and eight months of age.

Typhoid fever may be described as an infectious disease, due probably to more than one cause, the chief of which is the bacillus of Eberth, and is characterized by a continued fever lasting from one to three weeks, and a peculiar eruption of small rose-colored spots which disappear on pressure and appear in successive crops. Along with this are certain characteristic lesions in the ileum, accompanied by gastro-intestinal catarrh. The prevalence of this disease among children is presumably much more extensive than we can ascertain, as many cases of mild and ill-defined character probably are never recognized as such. Especially is this true among the poor.

Causes.—The causes of typhoid fever may be said to be predisposing, specific, and contributory. Undoubtedly there are certain individuals who are more liable to this disorder than others, and these vary in their susceptibility. Many collateral causes influence susceptibility, of which the season of the year is one of the most pronounced; so much so that it has received the name of "autumnal fever." Age also is an important factor, by far the largest number of cases occurring in later childhood, and most in early adult life, and less both above and below the ages of fourteen and twenty-five. There is little influence exerted by sex, climate, or mode of life. Atmospheric conditions affect the prevalence of the disease, dry heat seeming to favor, and cold and damp rather to check, its prevalence. The invasion is usually by the mouth and stomach. A degree of immunity seems to be acquired by repeated exposures to infection.

The bacillus of Eberth is constantly found in those dying of typhoid fever, but it is not proved that this alone is the exciting

cause of the disease. A number of causes may be described as contributory or supplemental, which were for a long time regarded as efficient. These are sewer-gases, evil odors emanating from various sources, defective ventilation, and the like. It is pretty well determined that these in themselves are incompetent to produce infection. They may possibly convey small amounts of poison to the air-passages, whence they become entangled in the mucus and are swallowed, but this is unlikely. By acting as profound depressants they may create or aggravate a condition of susceptibility, and they certainly do so depress the vitality as to diminish the powers of resistance. Enteric fever is, strictly speaking, contagious, but it is very rare to learn of instances of direct contagion. Undoubtedly, in the homes of the poor, where one member of the family is infected others acquire the disease. Here two causes are at work: a similarity of infective source and direct or immediate contagion. Nurses in hospitals have acquired the disease, presumably from handling the dejecta —the feces and urine—or by food thus contaminated, and the soiled clothing. Thus bacilli may be passed by accident into the mouth, and thence proceed to work their mischief in the ordinary way. Flies or other insects may be the obscure source of conveyance.

Immediate contagion is by far the most common. In most instances the poison is conveyed by drinking-water. Various articles of food, particularly infected milk, are equally responsible, but this again may be directly or indirectly through water conveyance. The bacilli retain their vitality for weeks in water, but probably do not increase therein to any extent. They retain their virility for a month or more, even when dried. They may live in ice for months. In the soil they remain vigorous, and also increase, and so in milk; they are readily cultivated without changing their appearance. "Once in the intestinal canal, the typhoid germs probably do not, like the cholera bacilli, increase in the secretions, but penetrate the epithelial lining and reach the lymphoid tissue, upon which they exert their specific action, causing a cell proliferation greatly in excess of the physiologic process" (Osler). When introduced into the human body, the bacillus is capable, under favorable circumstances, of indefinitely reproducing itself and retaining its activity. It tends to collect in certain organs, especially in the liver and spleen. "The bacilli penetrate into the solitary follicles and Peyer's patches, and there multiply and form colonies. From these colonies they migrate by way of the lymphatic vessels to the mesenteric ganglia, and by way of the radicles of the superior

mesenteric veins to the liver, to be finally distributed by the blood current to the spleen and other organs" (Wilson). They are excreted by the kidneys, as well as by the bowels. Incubation varies enormously and is variously stated to be from two days to three weeks.

Morbid Anatomy and Pathology.—The postmortem findings in typhoid fever are thoroughly characteristic and quite independent of symptoms. The febrile movement and various items making up the clinical picture of enteric fever are quite independent of these lesions, and are due to the action of specific poisons or toxins. The anatomic lesions, as pointed out by Wilson, fall naturally into two groups, the first including those which arise from the local action of the bacilli and their concentrated ptomains, and affect changes chiefly in the lymphatic system and the intestinal canal. The second group includes lesions due to long-continued constitutional infection, consisting of degenerative changes in various tissues and organs, particularly the liver, kidneys, voluntary muscles, heart, salivary glands, and pancreas; less conspicuously in the nervous system. These last are least extensive and conspicuous in children, nor have they been so carefully studied. The most conspicuous lesions are seen in the digestive tract, though here the destructive changes are far less than in adults. Ulceration, while not infrequent, is much rarer than in adults; the process is more of a hyperplastic change. Oftentimes there is only moderate redness and swelling of Peyer's patches, solitary follicles, and mesenteric lymph-nodes, lesions frequent in cases of simple diarrhea. We now know that typhoid fever can exist without any intestinal lesions whatever. Sometimes the disease occurs in the nature of a septicemia, or the process may be localized in the pelvis of a kidney, in the gall-bladder, in the periosteum of some bone, or in other tissues. Park speaks of the great importance of recognizing the nature of the disease in these irregular instances. Sometimes the pharynx exhibits diphtheric exudation; the esophagus is at times ulcerated, and the mucous membrane of the stomach inflamed. The constant and characteristic lesion is of the solitary and agminated glands in the lower part of the ileum, evidenced at first by swelling and hyperemia, attaining their maximum about the end of the first week, and then undergoing resolution without ulceration. If the lymphatic infiltration continues, in another week necrosis results and an ulcer is formed, which in children has a tendency to heal. If the ulceration becomes deeper, it may involve the whole of a Peyer's patch, and, attacking the walls of an artery, produce hemorrhage, or the wall of the intestine may be perfor-

ated unless protected by a plastic lymph. Hyperplasia of the lymph-follicles, in children especially, occurs in other diseases involving the intestines, as in measles, diphtheria, and scarlet fever. In children the swelling of Peyer's patches is seen earlier than in adults, and most often near the ileocecal valve, but is also found higher up in the small intestines. Under six or seven years of age the process is much less severe. Hemorrhage is also comparatively rare, and seldom occurs earlier than the third week. The spleen is usually found swollen and in all cases more or less involved, but distinctly less so than in adults. Various other changes incident upon intense toxic infection and protracted fever are seen in other organs, such as a hyperemic state of the liver, diminished amount of bile, degenerative changes in the kidneys, with or without albuminuria. The heart is liable to involvement, and while endocarditis and pericarditis are rare, the myocardium is liable to become relaxed and flabby or may undergo fatty degeneration. The voluntary muscles suffer sometimes profoundly. The lungs exhibit characteristic changes resulting from enfeebled circulation and obtunded nerves. Hypostasis is common, also pulmonary edema. Lobar pneumonia not only occurs, but sometimes appears at the beginning.

Symptoms.—The course of typhoid fever in children, while less severe, is very similar in its more conspicuous features to that of adults. It is of shorter duration, with the nervous phenomena at times overshadowing those of the intestines. This is true of by far the larger number of cases as seen by the average observer. We are more liable to meet with and recognize instances of the disease which pursues the ordinary course, as seen in older folk. There are those who do not agree with this view, but regard the disease as manifesting itself differently in children. The successive periods of development are not so clearly defined. Very many less well-marked cases escape attention, unless it be very sharply aroused, and this frequently happens, the cases presenting themselves only during a relapse or in the stage of subsidence. In young children the disease is more apt to begin with a sudden onset, with many of the symptoms fully developed. The febrile process is generally less severe, although the temperature-range may be equally high. The symptoms rarely reach the same severity as among adults; the complications are fewer, and the sequelæ less marked. We recall no less than twenty cases of typhoid fever in children ranging from five to twelve, occurring in the last five years, which pursued a perfectly typical course, with recovery. We can also recall probably twice that number of children

applying at the out-patient department of the Children's and the Polyclinic Hospital service that we regarded as probably suffering from typhoid, but who disappeared from view after but one interview; the most of them got well, as we have reason to know. Had there been increased severity or complications, the greater part of these would have again applied for advice. They were subsequently seen for slight ailments in no way connected with this disease. Certain other cases gravely suspected of being aberrant typhoid presented themselves regularly until quite well. Prodromes, except in severe instances, are usually of the vaguest, and these are generally connected with the digestive tract. Nosebleed is rare in children, and so is diarrhea, and headache is seldom complained of. The temperature, when typical, rises slowly for from two to seven days, remitting a degree or two, or even three, in the second week, declining steadily in the third week, at the end of which the normal is reached; it may even appear to fall by crisis in some cases. It may shoot up abruptly to 102° or 105° F. (38.8° to 40.5° C.) at once, but later run the regular course of gradual rise and fall, morning remissions with evening exacerbations, oftentimes by no means so marked as with adults, and may even be absent. The pulse is frequently found to be slower than should be expected from the degree of temperature, as in older folk.

In young children the febrile progress is often only from eight to fourteen (8 to 14) days (Morse), the average course under ten years is 19.3 days; ten to fifteen years, 22.6 days; after the age of ten this course is much like that of adults. The maximum fever in mild cases is 103° to 104° F. (39.4° to 40° C.); in severe cases it may reach 105° to 106° F. (40.5° to 41.1° C.) —higher than in adult cases of similar severity.

Typhoid fever is perhaps the only disease in which the temperature runs higher in older than in younger children (Holt). Subnormality obtains at the end of the course, and rises are due to intestinal or other disturbances. The tongue is not so characteristic as in adults, and may be quite clean. There is a peculiar thick, heavy coating, with the tip and margins free, with sometimes a V-shaped oval red place in the center, which is claimed to be pathognomonic; but the absence of striking lingual features is in no way reassuring. There is usually loss of appetite from the beginning, but food will be accepted, nausea being rare and vomiting more so. The mouth, tonsils, and nasopharynx usually appear inflamed, and may exhibit a fairly severe catarrh, especially in those of impaired nutrition. The bowels are rarely loose, at least it seems so nowadays, constipation

being much more frequent than was formerly taught. It is present in about half the cases (Holt; Morse says one-third). Constipation at the beginning may be succeeded by diarrhea later in the attack. The gurgling and pain in the right iliac region mean comparatively little in children, because they can be so constantly elicited even in the well. The spleen is always enlarged, though not always palpable (about 15 per cent.), and is quite a characteristic and early sign of typhoid fever in children; it is also often tender. The size is an index of prognosis as well as of diagnosis; while it persists, the disease is not ended. The eruption, which is a very common symptom,—60 per cent. of cases,—is noticed early in the course of the disease, and consists of pale-red, "rose-colored," flat, slightly elevated spots which, on being pressed with the finger, disappear for a moment and reappear somewhat slowly. They are usually few and scattered, but occasionally very abundant; generally seen on the abdomen, but if in large numbers, they may also be found on other parts of the body. They are found on the back, in the region of the shoulders, at times, when absent elsewhere. The abdomen is usually more or less distended, and increasingly toward the middle or latter end of the course. There is almost always very early slight sensitiveness on pressure, but tenderness in children is seldom extreme, and more apt to be present along with constipation. Marked tympany is rare. Abdominal pain is absent. Colic may accompany or precede an action of the bowels. The kidneys are seldom disturbed seriously. There is no constant relation between the condition of the bowels and the intestinal lesions.

The heart, while enduring more readily the depressing effects of the fever in children than in adults, nevertheless requires very careful watching, as asthenia is by no means rare, and collapse has been known to come without warning. Savestre asserts that syncope and death may occur with the utmost suddenness, and that it is more important to watch the pulse than the temperature-range. The disappearance of the first sound of the heart, while not a grave symptom, is an indication for increased caution and stimulation.

Relapses, which are as common in children as in adults, are practically reinfections, and are more liable to occur after a mild than graver attacks. One attack induces a fair, although by no means certain, immunity to subsequent infection. Disturbance of the respiratory system, especially at the beginning, is so common that it may be regarded as a phenomenon of the disease. Cough is common, without corresponding physical signs. Bron-

chitis, when present, is usually of moderate intensity. If bronchopneumonia occurs, the respiratory murmur becomes much weakened, and percussion resonance is impaired on the surface of both lungs. A mere hypostatic congestion is also not uncommon, especially where the circulation is enfeebled.

Complications and Sequelæ.—In children these are mild and not frequent. Bronchitis is a usual accompaniment. Intestinal hemorrhage, perforation, and peritonitis are the commoner and more serious complications. Nervous symptoms are often present, but rarely severe. Chorea is not uncommon, and aphasia will be found oftener than in older patients, while posttyphoid insanity is rare. Certain of the tissues are liable to suffer apparent parenchymatous inflammation, as the kidney, parotid gland, and muscles. Otitis and parotiditis are commoner than in adults. Certain complicating conditions involve the lungs, as thrombosis, embolism, hypostasis, edema, and pneumonia occasionally. The exanthemata may precede, coexist with, or follow typhoid fever. So also of diphtheria and whooping-cough. Tuberculosis does occasionally follow.

Diagnosis.—In children, as has been said, the progress of typhoid fever is attended with so much irregularity that the diagnosis is oftentimes exceedingly difficult, and frequently it is not recognized at all. Epistaxis is rare, catarrh of the respiratory tract is common, and the temperature-range is more irregular than in adults. Vomiting is oftentimes the first symptom. Neuroses are frequently prominent, but signify little; there are often restlessness and delirium, and many times headache, but seldom convulsions. Constipation rather than diarrhea prevails. The rash, the severity of which bears no relation to the severity of the disease, is usually slight; fatal hemorrhage and perforation are seldom seen. The characteristic phenomena are the enlargement of the spleen, eruption, peculiar temperature-range, and abdominal distention. The method of testing the blood after the manner of Widal will make the diagnosis much more exact in future.*

---

* *The Serum Test for Typhoid Infection.*—In March, 1896, Pfeiffer and Kolle published an article in which they claimed that the serum of convalescents from typhoid, when mixed with cultures of the typhoid bacillus and injected into the peritoneal cavity of a guinea-pig, produced a specific reaction. The bacilli become agglutinated and finally deformed and dissolved, and this change takes place only with typhoid bacilli when typhoid serum is used, and is due to the bactericidal action of the typhoid serum. This reaction was also demonstrated in a test-tube, the bacilli falling in fine, whitish flakes and settling at the bottom after a bouillon culture was mixed with the serum from an immunized goat and placed in the incubator for an hour. The first practical application of this method of diagnosis on a large scale was made by Widal, and reported June, 1896, in "La Semaine Médicale." He found finally

Apathy, which is occasionally seen in children, is rare, together with subsultus, coma vigil, and stupor, so common in adults.

Gastro-intestinal disturbance is generally present from the be-

---

that by drawing blood from the finger of a typhoid-fever patient and allowing it to clot so that the serum separated, and if such serum were then added drop by drop to a broth culture in proportion of one to ten, at the end of twenty-four hours the bacilli were agglutinated and immobilized. Later he noted that the dried serum and the dried blood showed this specific action, occurring as early as the seventh day of the fever, and remaining for a considerable period after recovery. Widal and Achard made further tests to ascertain the properties of the agglutinating substance. It was found in the serous fluid of blisters, serum from pus, tears, urine, and milk of persons sick with typhoid fever. This property resides in the globulin and fibrin, but not in the plasma of the blood. The reaction is most pronounced at the height of the infection. It has disappeared one day and reappeared the next, but, as a rule, diminishes in intensity soon or late after convalescence—months or years. In some cases it does not appear before the third week, and rarely not at all. Wyatt Johnston, of Canada, introduced the method into municipal laboratories, and suggested that the blood be dried on a glass slide and sent by the physician to the laboratory. The technic at present employed is to obtain a few drops of blood from the cleansed finger or ear-lobe of the patient, and allow it to dry on a piece of clean paper or a glass slide. This specimen is then sent to the laboratory, where the dried blood is mixed with five times the quantity of water. A drop of this mixture is placed on a cover-glass, and to it is added a drop of a fifteen- to twenty-hour bouillon culture of the typhoid bacillus. It is then examined under the microscope in a hanging drop. In a few minutes (five to ten) the reaction occurs, a few bacilli moving slowly, while the mass of the bacilli is nearly motionless and clumped together, or all the bacilli may have ceased moving and be collected into clumps. The test is quantitative, not qualitative; agglutinating substances are present in normal blood, but in far less quantity. In the blood of a sufferer from typhoid fever the reaction takes place much more quickly and effectively and in greater dilution; the test, to be proper, must occur in a 1 : 10 dilution of dried blood, and within ten minutes. In two thirds of the cases of typhoid fever it is possible to make a positive diagnosis by this means. The absence of the reaction in any single examination does not exclude the diagnosis of typhoid fever, but the absence in a series of examinations is of value in excluding the disease. Opinions appear to be divided as to the value of the reaction, some holding the positive reaction to be of decisive importance, while others assert that the test is unreliable in a positive as well as a negative sense.

Fischer ("Zeits. f. Hyg. u. Infect.," 1899, XXXII, 407) holds, and with reason, that in all cases where the reaction has been positive, it should be shown scientifically that the patient actually had typhoid fever, by the demonstration of the presence of the bacilli, or that the patient had not within a reasonable period suffered from an attack of the disease, and that the proper dilution of the serum was used in the test. And, again, in the event of negative results, it should be clearly shown that the patient was not suffering from typhoid. In other words, it must be shown, on unimpeachable evidence, that the patient had or had not the disease. Cases of positive results are described by Ferraud, Kasel, Mann, and Fischer, which were evidently not typhoid. Busch, Schumacher, and Fischer describe other cases of unmistakable typhoid which gave negative results.

It would seem, however, from the cases at hand, that care should be had that the serum should be correctly diluted; also that the observation be particularly made of the paralysis rather than the clumping of the bacteria, and that, when possible, the tests should be controlled by bacteriologic examinations.

Solutions of the serum stronger than 1 : 10 may give the reaction, even from healthy blood. As a practical clinical point for control examinations it might be suggested that pure cultures of the bacteria can be gotten from the urine of a majority of the patients, and this is especially so when the urine is found to be cloudy.

M. V. BALL.

ginning, but seldom in the form of severe diarrhea, and causes this disease to be readily confounded with pronounced and subacute disturbances of the digestive tract. The spleen can nearly always be felt, and is increased in size. It has been suggested to puncture this in suspected cases, and to examine the blood for the bacillus of Eberth. The rose spots will generally be evident at the end of the second week, and by this time the clinical picture is generally clearly marked, the most important feature of which, as in adults, is the temperature-range, with its morning remissions and evening exacerbations in steady progression to the characteristic gradual descent. During this period the diseases with which typhoid fever may be confused are meningitis, influenza, tuberculosis, enterocolitis, remittent fever, and even smallpox and trichinosis. In meningitis there are usually vomiting at the onset, marked headache, and tendency to retraction of the abdominal walls; in tuberculosis the temperature-range is irregular, there is rarely tympany, the belly is flat, and the delirium, when present, is apt to be wilder. Influenza strongly resembles typhoid fever, at least for a short time, but the febrile process is more abrupt, and the organic disturbances are more rapid and pronounced. Remittent fever in malarial countries is a large source of confusion with typhoid, and particularly so where, as sometimes happens, typhoid fever is modified by the malarial poison. The ready examination of the blood for the plasmodium malariæ will at once make clear that element. Simple continued fever, due to toxins produced by disordered digestion, should always be borne in mind. Again, when other cases are found in the same household, the diagnosis is rendered less difficult.

Prognosis.—As has been said, a statistical knowledge of the prevalence of typhoid fever in children is exceedingly inexact, many cases escaping recognition altogether. The mortality among children is certainly low, probably much less than 1 per cent. Some authors claim 3 to 4 per cent. In those of good vigor, not weakened by previous disease or organic weakness, death is rare, and when it does occur, is liable to be due to some complication and not to the disease itself.

Treatment.—The preventive treatment of typhoid fever is particularly important, because thoroughly controllable, but has to do rather with the subject of hygiene than practical medicine. The water-supply of cities ought to be entirely free from infection, and when this is accomplished, typhoid fever will become rare. Summer resorts are particularly liable to epidemics of typhoid, where considerable crowding of an alien population

overtaxes local health precautions; hence it is wiser to make large use of boiled water or reliable bottled waters when not absolutely certain of the local supply. The same may be said of milk, in which the typhoid bacillus may readily appear and grow, the source of which may be an infected cow or well. The question as to whether typhoid fever can be aborted or not can only be answered by quoting individual opinions. In a suspected case the early administration of calomel (gr. j to gr. iv) is a rational procedure, and is productive of no harm and possibly of much good if resorted to in the first three or four days. Other intestinal antiseptics, combined with laxatives, may work with advantage. In no other disease is it more important to insist on absolute rest in bed from the first suspicion to the very end of the specific process and perhaps a little beyond—at least a week or two. If the child is away from the place where it can best be nursed,—at its home or a hospital,—it is wise to convey it there with all due precautions, even at some slight risk. A well-appointed hospital is best for rich or poor.

The *diet* must be regulated with the utmost exactitude as to kind, quality, and hours of administration. Only fluids are safe, and milk in some form is the main reliance, and should be continued until apyrexia has lasted about ten days. It should be sterilized, Pasteurized, or boiled, and thus is afforded some slight variety of taste; in other ways changes may be wrought by dilution, as with effervescent waters—Vichy, Giesshübler, or others. It may be variously flavored or modified by the addition of aromatic or diluent substances. Barley-water and thin oatmeal water are often excellent additions. Milk is much improved in its digestibility by being violently shaken in a bottle, where it thus acquires a sparkling quality very grateful to a jaded stomach. Unless the digestive tract is in good tone, curds are liable to form in large masses and fats to collect in lumps, and thus irritate the intestine and work considerable mischief. It is sometimes necessary to use only skimmed milk; at other times cream and water. Where milk has seemed to disturb the intestines, it is well to use only broths for a day or two, or the raw whites of eggs stirred up in water, meat-juices, or whey. After the stomach has thus been rested milk may again be used, preferably predigested, alternating with some meat-juice or broth, and gradually thus get back to a plain milk diet. Much ingenuity should be exercised with even these fluid substances, and the urgent petitions of the family to use solid food be smilingly put aside by concessions of this innocent sort. The addition of a few drops of brandy or whisky is sometimes most grateful, and even of Maraschino or

Jamaica rum. Indeed, it is well to add a few drops of some spirits or of extract of vanilla to the milk occasionally by way of a treat, and especially to the egg-water. The fermented milk known as koumiss is relished by some children, but not by all. Well-made vanilla ice-cream, diluted with Vichy,—a favorite drink with many children,—is also a safe occasional substitute. The amount of milk necessary varies considerably, a pint a day being sufficient to support life, especially if it is well digested and diluted; a few days later it may be necessary to increase this, and to decrease promptly if the food distresses. Three pints of milk a day is the maximum, beyond which it is scarcely safe to go. This may be supplemented, however, by thin broths or replaced by more sustaining meat-extracts. Many careful physicians allow for older children soft-boiled eggs occasionally; others use thin gruels or even milk-toast. Calf's-foot or wine-jelly has a solid or agreeable taste, and yet leaves no residue to irritate the intestines. Junket or coagulated milk is also of value. There is a growing confidence in the use of a fuller, more varied dietary in uncomplicated cases. We enjoy the conviction that this is most rational, and under this system convalescence is earlier and much strength conserved. It is often important to use some remedies to aid digestion; the normal HCl is absent in the height of the fever. The drinking of water should be encouraged; to this may be added from five to ten drops of hydrochloric acid to a tumblerful of sweetened water, as a not unpleasant disinfecting drink; this relieves the condition shown by dry lips and tongue, which is more common among adults. Pepsin with muriatic acid at times is needed. If diarrhea is present, pepsin, along with the diluted sulphuric acid, is better; brandy may be added to this with advantage.

The physician must bear in mind that relapses are due to two causes: one, not altogether under his control, a reinfection; the other, absolutely in his power, indiscretions in diet; and from this last also frequently arises sudden, unaccountable death. One week after all fever has ceased we may cautiously begin the use of more solid foods; here the animal broths come in again, in which may be placed a few stale bread-crumbs, bits of toast, or Zwieback, thoroughly softened in milk or broths. A safe and very acceptable dish is a piece of not too tender broiled beefsteak, mutton chop, or chicken, which is to be masticated and only the juice swallowed; but the mere act of chewing is a great joy to a hungry child. This may be usually allowed from the beginning or middle of the second week. Then come scrambled eggs and scraped meat, rice- and milk-pudding, and finally the various bread preparations, carefully selected.

Baths.—For the treatment of the fever antipyretic drugs are to be avoided or most cautiously administered, the main reliance for lowering the temperature being upon cool or cold baths. There is no danger of the child taking cold when the temperature exceeds 102° F. (38.8° C.). Cloths wrung out of cool water (80° to 60° F.), laid upon the body and head, will also be found grateful. A more effectual method is for the child to be entirely swathed in these, beginning with warm water at 95° F. (35° C.), and replacing by cooler and cooler water, 80° to 60° F.; or a piece of rubber cloth may be slipped under the child, the four sides propped up, and tepid (85° F.) or cool water (75° to 70° F.) poured in, forming a superficial bath. This is known as the wet-pack and should be continued for at least ten to thirty minutes. In hyperpyrexia with delirium the patient may be placed in a full bath with great advantage, or use the cold pack with iced water. Full directions for bathing are given in another place. At all times the temperature should be carefully watched to see that we are not producing a condition of collapse; if so, or if the extremities grow cold, dry heat must be promptly applied, with stimulants by the mouth or rectum or hypodermically. The inhalation of oxygen is often used. Cold baths or applications are rarely contraindicated, except when there is a marked depression of the circulation or when a hemorrhage from the bowels is threatened, and then only on account of the disturbance caused to the abdomen and intestines in the handling of the patient.

A valuable adjuvant to the cold bath in hyperpyrexias is the maintenance of a cool temperature in the room, by the free opening of the windows, even if the temperature of the room remains stationary at 60° F., and it is equally important that the patient should only be covered by a sheet or very thin blanket. In this there is no danger and practically no discomfort, so long as the temperature remains at or near 102° F. (38.8° C.). For older children the full directions for bathing as outlined by Brand are to be followed.

Drugs.—Of the coal-tar antipyretics, antipyrin and phenacetin are preferred by some and acetanilid by others; guaiacol, locally, has many adherents, but its effect is transitory and should be carefully watched when applied. Quinin, if there is malarial complication, acts happily, but is capable of doing harm. It is best given by the rectum. If antipyretics are used, it is well to combine with them some stimulant or cardiac tonic, as strychnin. The use of the occasional antipyretics, acetanilid or phenazone, along with the tepid bath or sponging and a little

brandy or wine whey, gives most gratifying results. For tympany, enemata of iced water, alone or in combination with some carminative, as fennel, catnip, or camomile water, or with one or two teaspoonfuls of turpentine (emulsified by white of egg), relieves admirably. Turpentine by the mouth is perhaps the most satisfactory of all remedies to relieve abdominal distention or intestinal distress, which so frequently arises during the second week, and is especially indicated when the dry, dark-brown tongue appears. Where there is diarrhea also, the turpentine may be administered with aromatic sulphuric acid; to this may be added bismuth, naphthalin, salol, or a minim or two of tincture of opium. It is sufficient to give turpentine (gtt. iij to gtt. vj in emulsion or in the white of egg) every four hours for meteorism, but to check diarrhea these and the other substances just mentioned should be given every hour or two while demanded, and the interval lengthened when this ceases. Tincture of asafetida is useful here. One of the most powerful astringents, and yet a safe one, is acetate of lead. Collapse calls for powerful stimulants by the mouth, rectum, and subcutaneously—dilute alcohol, caffein, musk, camphor in sweet almond oil, 1 : 4, and benzoate of sodium are the best to employ.

Chloral is of value when insomnia or great excitement prevails, but should the heart be enfeebled, croton chloral is preferable. Should heat in the head accompany these symptoms, cold applications of iced water or an ice-cap is very soothing, and the head should be kept as high as comfort will allow.

For constipation, which is as common as diarrhea is children, it is perhaps best to wash out the lower bowel every other day with warm water. To the rectal injections may be added turpentine or castor oil, or both. A valuable internal remedy is olive oil in good-sized doses: entirely harmless, laxative, nutritive, and protective to inflamed surfaces. When diarrhea is present, frequent irrigation with water at about 100° F. (37.7° C.) is useful. Should the discharges be offensive, the addition of thymol or permanganate of potassium is advised; here the internal use of bismuth, salol, or naphthalin is recommended by some. Tympanites is to be combated with turpentine stupes, a flannel cloth wet with and wrung out of a mixture of one tablespoonful to a pint of hot water; by the internal use of thymol or turpentine; and when a grave complication, by hot enemata. If hemorrhage occurs, food must be withheld altogether for a time; when given, it should be in small amounts and cold, and an ice-bag applied to the right iliac region. As hemostatics turpentine and ergotin hypodermically or gallic acid act hap-

pily. Hemorrhage in the typhoid fever of children is liable to cease soon, and too much interference should be avided. If symptoms of perforation become evident, a surgeon skilled in abdominal section should be called in consultation, who, by prompt operation, may sometimes save life. Hypostatic congestion should be prevented as much as possible by shifting the position slightly, which is easily done by wedging up the mattress or the sheet an inch or two under the side of the child, leaving it so for an hour or more, withdrawing this and shifting the wedge, which may be a folded towel or a roll of cloth, to the other side, and raising it an inch or more; thus the attitude of the child is changed a little and the blood encouraged to gravitate obliquely in these successive directions rather than vertically. Pain in the legs frequently results from their long-continued extension, and is relieved by supporting the knees on a folded Turkish towel or small pillow.

DIPHTHERIA.

Diphtheria is an acute, infectious, and inoculable disease, of bacterial origin, occurring sporadically and epidemically. It is characterized clinically by a specific inflammation of the mucous membrane of the throat, followed by the formation of a membranous exudate upon, and resulting in a local necrosis of, the parts affected, and by the development of a peculiar toxemia.

This disease usually selects for its site the pharynx and upper air-passages; it also appears in the nose, and exhibits a marked tendency to spread to other mucous surfaces, even to the utmost ramifications of the bronchi, and is attended with engorgement of the associated lymphatic glands. Occasionally it attacks the abraded surfaces of the skin and the freshly cut surfaces of recent operations.

Constitutionally, diphtheria is marked by irregular fever and pronounced debility, and it is frequently accompanied by albuminuria. Death is brought about usually by toxemia, heart failure, or mechanical obstruction of the air-passages by extension of the fibrinous exudate. It is followed by a slow, irregular convalescence, sometimes by lymphatism, and in severe cases by a peculiar blood cachexia resulting in marasmus, and frequently by peculiar forms of paralysis.

Causes.—Diphtheria is a disease caused by the activity of the bacillus diphtheriæ (Klebs-Loeffler). Several microbes are found associated with this in the mouth and throat, among others the staphylococcus albus and aureus and the streptococcus pyogenes,

which may themselves become active and alter the course of the disease. (See Septicemia.) Certain harmless microbes may also

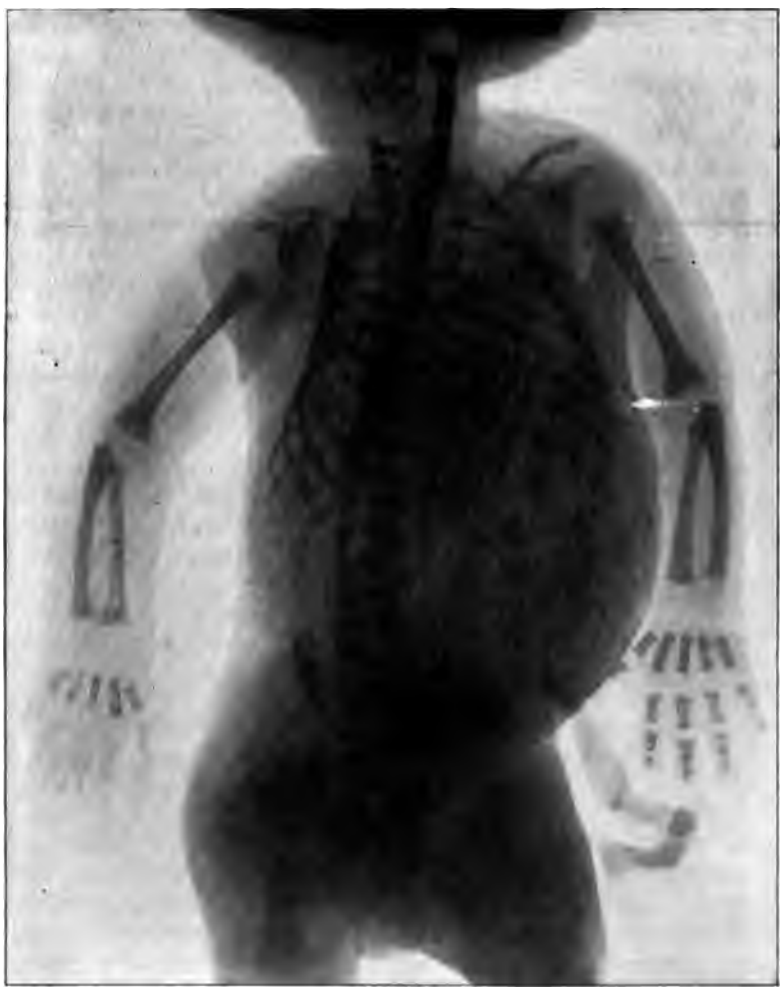


FIG. 40.—SKIAGRAM OF A WELL-DEVELOPED MALE INFANT A FEW HOURS AFTER BIRTH (O'Dwyer's intubation tube still in the throat).

be present, and even accumulate in the lymph-vessels leading from the inflamed surface.

By some diphtheria is still regarded as a constitutional disease, with a local manifestation, developed during its course. The

preponderance of the clinical and bacteriologic proof is in favor of the view that it begins as a local malady. The bacillus diphtheriæ was discovered by Klebs in 1883, and Loeffler in 1884, who was the first to isolate and cultivate the micro-organism, which bears the joint name, Klebs-Loeffler. Inoculation into the lower animals produces the characteristic syndrome of diphtheria, which is the formation of false membranes with an underlying necrosis, along with paralysis and albuminuria. The bacillus produces certain ptomains or toxins, which are absorbed by the lymphatics and blood-vessels and give rise to serious constitutional symptoms. The bacilli themselves are regarded as harmless, except for the power to produce specific ptomains. The isolated toxin, if introduced in small increasing amounts into the circulation of animals, produces an increasing degree of immunity. The serum of such immunized animals produces immunity in man. The action of the attenuated diphtheric virus when injected into man or animals destroys the toxins formed by the bacilli, but not the bacilli themselves. This constitutes a biologic antidote.

Diphtheria is common among certain of the domestic animals, particularly cats. It is easily transmitted from animals to man, and conversely. Cows which have recently calved frequently suffer from an affection which dairymen call "chapped teats." This has been found to be identical with the condition produced by inoculating the teats with Klebs-Loeffler bacilli. When it is taken into consideration how favorable a medium for the cultivation of the diphtheria bacillus cow's milk is, and how rapidly these germs multiply, an epidemic of diphtheria may thus be easily started.

There is ground for belief that there are two varieties of diphtheria bacilli—the one virulent (pathogenic) and the other harmless (nonpathogenic). An innocent variety of diphtheria germ is often to be found in the pharynx of healthy children and others. False membrane appears upon the mucous surfaces from various causes, chiefly from irritation other than that of diphtheria. The habitat of the microbe when outside of the body is not yet clearly understood, but it is found in filthy accumulations, especially of human and animal refuse, and has a marked causal relationship to damp localities. It has been noted that diphtheria began after the use of horse manure on a field or garden spot in a locality hitherto free.

Diphtheria is transmitted usually by direct contagion, although it is capable of transference by various means and is inoculable. Diseased or abraded surfaces are far more susceptible

than healthy ones, and mucous surfaces are the usual site. The radius of contagion is limited to a few feet, and with reasonable precaution it is not dangerous to approach one so affected. Unhygienic conditions, such as dampness, darkness, and the like, not only favor the spread of diphtheria, but lower the resistance of those who live under such devitalizing conditions. Direct contagion is not nearly so large a factor in the propagation of diphtheria as foul drains and filthy collections of animal refuse. Children are much more susceptible to diphtheria than older persons, but the disease may occur at any period; white children under five are most susceptible (Billings). The propagation is favored by cold and damp weather, unhygienic surroundings, excessive exposures, and overcrowding. One attack does not confer immunity, but, on the contrary, seems to render one more susceptible to the disease. Diphtheria may accompany other diseases, especially acute disorders of the throat. Epidemics of diphtheria are apt to follow the prevalence of other contagious diseases. Diphtheria and typhoid fever frequently prevail at the same time and in the same locality. Laryngeal diphtheria frequently complicates measles, and is a most fatal sequel thereto.

Pathology.—In diphtheria the inflammatory processes are more commonly confined to the fauces, tonsils, and pharynx, although they frequently extend to the nose, trachea, and bronchi, and occasionally to the mouth, lips, esophagus, conjunctiva, middle ear, stomach, and genitalia. It may also affect freshly cut surfaces, notably tracheotomy wounds, the prepuce in circumcision, and the umbilicus in the new-born.

The membrane presents at first a whitish, then an opalescent, and finally a muddy gray, appearance; in the last stage it resembles a necrotic portion of mucous membrane. This false membrane is very adherent, but when forcibly removed, displays a hyperemic mucous membrane beneath, usually intact, and only rarely, except on the tonsils, is there a tendency to ulceration. During the progress of the disease the exudate becomes quite thick, and is composed of several layers of fibrin, the lower ones being the most recent in formation. In the tonsillar variety it may be in such mass as to block the passages between them completely. If the membrane covers the pharynx and uvula, it may appear as one sheet, and when separating, may do so in a mass, leaving a healthy mucous membrane beneath.

In the nasal variety the membranes are thickened, of pinkish color, and separate in mass. In the laryngeal variety the membrane is white, sometimes pinkish, and may extend to the trachea

or even to the bronchi, and may also be rejected in mass, exhibiting a cast of the parts obstructed. The lymph-nodes of the cervical region are very frequently affected. The spleen is enlarged and congested, and the pulp is softened. The liver, also, is congested, with areas of necrotic cells peculiar to this disease. In the kidneys hyaline changes in the glomerular capillaries and small arteries are characteristic features of the nephritis of diphtheria, according to Welsh.

In malignant cases dying early cardiac thrombi are found, and the heart muscles are invariably affected. Degenerative changes have been demonstrated in the cord and spinal nerves, as well as in the pneumogastric and accessory nerves.

Bauer and Deutsch, who examined the stomach-contents of a large number of children suffering from diphtheria, found that in no case was there free hydrochloric acid present, and the amount of the combined acids was lessened. After the injection of antitoxin the free hydrochloric acid reappeared in the majority of instances in from twenty-four to forty-eight hours. When it did not, the amount of the combined acids was greatly increased. In fatal cases which had been injected the free hydrochloric acid did not reappear at all, and this may be of value in prognosis. In cases treated without antitoxin free hydrochloric acid did not come back until full convalescence. The motility of the stomach was in proportion to the amount of acid. The absorption remained normal.

Bronchopneumonia, edema of the lungs, and emphysema are also frequent sequences, and by reason of the various pathologic changes the blood itself is altered, a reduction being found in the number of the red corpuscles as well as of the hemoglobin.

The Membrane.—The fibrinous network contains within its meshes numerous epithelial cells, leukocytes, serous exudate, and diphtheria bacilli. The upper layers of the membrane also contain great quantities of cocci, which, however, bear no known relation to the etiology of the disease. The mucous membrane itself shows inflammatory infiltration.

Symptoms.—The incubation period of diphtheria varies from two to ten days, according to the severity of the epidemic and the physiologic resistance of the patient. The symptoms are both local and constitutional. Mild and malignant cases develop near and from each other.

The prodromes of diphtheria resemble those of other infectious diseases, exhibiting slight chills, moderate fever, malaise, and some degree of pain in the back and limbs. In the onset of very mild cases the symptoms may be trifling, so that the

patient is soon up and around. As a rule, fever in the first twenty-four hours of the attack may reach 102° or 103° F. (38.8° to 39.4° C.); in severe cases the temperature may be subnormal. The course is quite irregular. The pulse is rapid and feeble,—from 100 to 120 beats a minute; sometimes a drop of one in twenty beats occurs,—and very frequently it is dicrotic. The first well-marked symptoms in a typical case are usually those of throat inflammation: the little patient complains of difficulty in swallowing, feels tender under the jaw, and somewhat stiff in the muscles of the neck. In twelve or twenty-four hours from the onset a grayish pellicle often forms upon the tonsils, and the cervical glands will be found swollen.

The most characteristic feature is the constitutional disturbance with marked debility, which is out of proportion to the severity of the fever. At first the throat may show nothing, or be only hyperemic and swollen. Spots may not be seen at first, or begin as small, adherent patches, grayish or yellowish white, usually upon the inner surface of one or both tonsils. These may at first be scarcely perceptible, except as slight opacities, but the tendency is to spread, covering the tonsils and meeting in the center. There is little or no pain, or it may become severe. Weakness and pallor increase. The course of the fever is irregular. The heart early shows special enfeeblement, the breath becomes fetid, and the tongue is usually coated and swollen. The appetite disappears, nausea may appear, and the bowels become costive. The glands of the neck are usually swollen, sometimes symmetrically. The urine may grow scanty and highly colored, or maintain a natural appearance, with albumin showing in two or three days. In mild cases the symptoms subside in a week or ten days, the patient becoming much enfeebled and convalescing slowly; in severe cases the weakness grows extreme, and the obstructive symptoms progress. If the nose is involved, there are the usual symptoms of obstruction, and the secretions excoriate the upper lip and emit an extremely offensive odor. The glands about the jaws and neck become enlarged and tender, especially when the nose is affected, sometimes involving the connective tissue, stiffening the whole neck. When the larynx is first attacked, it usually begins on the third or fourth day, and is shown by hoarseness and obstructed breathing, with a peculiar croupy cough and symptoms of cyanosis, with increasing dyspnea. (See Membranous Croup.) The coughing-up of bits of membrane may relieve this for a time, but the membranes soon form again and the trouble may return and become urgent for relief. During the

progress of this local disturbance the constitutional symptoms are liable to grow worse, with depression of pulse and circulation and increase in the kidney complications, casts and blood-cells showing in the urine; along with this is an extreme prostration. Death may result from suffocation unless the symptoms are relieved by intubation or tracheotomy.

The difficulty of breathing may be due to increase in the amount of membrane, from swelling of the false membrane, the detachment of a portion stopping up the glottis, or acute engorgement of hypertrophied tonsils already existing; or else, on the one hand, the difficult breathing may be due to altered blood states, by reason of accumulation of waste matter in the blood, causing systemic depression by autointoxication, with subsequent heart failure. On the other hand, the altered blood disturbs the respiratory center and thus causes dyspnea, or, finally, by accumulations of poisonous waste matter and consequent systemic depression, heart failure is induced.

Albuminuria is present in nearly all well-marked cases, usually appearing between the third and the tenth day; this may be due to acute nephritis or to the effect of the toxins on the glomerular epithelium of the kidneys, or from imperfect aëration of the blood in the late stages of the disease.

Albuminuria is attributable to changes in the epithelium, the "acute degeneration" of Delafield. This change is brought on by the febrile state, causing cloudy swelling of the epithelium of the tubules. The amount of albumin is slight and usually disappears with the subsidence of fever, or albuminuria may result from the circulation in the blood of abnormal and irritating ingredients. This malady rarely leaves serious kidney trouble behind it.

The pulse is nearly always rapid, and if it falls below the normal, is a sign of serious cardiac weakness. Tirard says the chief characteristic of the pulse of diphtheria is its disproportionate rapidity as compared with the temperature. He also calls attention to the early loss of the knee-jerk in the first, second, or third day, and this, he claims, is a valuable aid in diagnosis.

A certain number of cases assume a malignant type even from the very beginning, and the system becomes overwhelmed with the intensity of the poison; or the severity of the disease may show itself in excessive membrane formation. The average duration is about ten days or two weeks, but mild cases recover in a few days. Severe and protracted attacks of the disease may last for weeks.

The paralyses which follow diphtheria are due to trophic

changes, and may be sensory, but are usually only motor. They are peculiar in many ways: One set of muscles may be losing its force while another is regaining, but all are likely to get well in the long run. The knee-jerks are usually absent, and there is little or no pain or tenderness. The part usually affected is the soft palate, which loses both power and sensibility and also control over the acts of swallowing and speaking. The muscles of the eye are sometimes paralyzed; also one or both vocal cords; or, again, the diaphragm of cervical muscles, sometimes the sphincters of the bladder and rectum, and frequently the whole lower extremities. (See Neuritis.)

Diagnosis.—Since the discovery of antitoxin and the specific results of its early use, greater efforts have been made for an early diagnosis. Certain specialists in diseases of the throat, and some who regard themselves as such, claim that they can differentiate between the simpler inflammations of the throat and the milder forms of diphtheria. To a limited extent this is true, but such diagnosis is not to be relied upon. The bacteriologic demonstration of the Klebs-Loeffler bacillus, which can now be secured with great promptitude and more or less thoroughness in all our larger and in many of our smaller cities, is the most reliable guide. But this also has its limitations, as has been well said by Welch: The mere presence of the diphtheria bacilli in the throat of a patient no more proves that he has diphtheria than the presence of the pneumococcus in his saliva establishes the fact that he has pneumonia. The only decisive method, as claimed with much justice by Runge, is control experiments in the way of animal inoculations. In the concealed forms of diphtheria, as in the trachea or the nares, the difficulties of diagnosis are large. But it is always safe to assume that a case is diphtheria when the very slightest patch appears before or after or during a croupy paroxysm, even should such a patch appear upon the tonsil, uvula, pharynx, or palate. The differentiation between croup and diphtheria is clinically separated, although in certain instances the diphtheria bacilli are demonstrated in the membranes of croup, and often absent in cases of croup resembling diphtheria. It is safe practice always to treat as diphtheria those cases of croup which become progressively worse, or which fail to respond to judicious medical treatment after the first twenty-four hours. Croup is a local disease, albuminuria is absent, the lymphatic glands are rarely enlarged, and no paralyses follow. The necrotic change is more superficial than in diphtheria. Where croup appears secondary to other diseases, such as measles, scarlet fever, or the like, it is always safe to look

upon this complication clinically as diphtheria, and treat it at once as such. (See Membranous Croup.)

Scarlatina exhibits a sore throat closely resembling diphtheria, although the two diseases may coexist. The scarlatinous throat is much more diffusely red than in diphtheria. There is also the characteristic tongue, but in the membranous anginas of scarlet fever, if the complication is not diphtheria, the patches will be found on both tonsils, and the tonsils, as well as the lymphatic glands, will invariably be found enlarged and swollen. The membranes in scarlet fever are found soft and spongy, and appear to be embedded in, and not upon, the tonsil, as is always seen in diphtheria. Bacteriologic examination shows the streptococci in scarlet fever, and not the diphtheria bacilli,* unless this last is a complication. In case of doubt it is a safe practice to administer the antitoxin, and where there is mixed infection, the additional use of the antistreptococcic serum is indicated.

Certain patients are met with who exhibit pseudomembranes, and cases of follicular tonsillitis with large exudation give much concern. (See Tonsillitis.) Where the history points to exposure, it is always a safe practice to give a curative dose of the antitoxin, even though the question of diagnosis be a debatable one. Every condition of acute sore throat in a child should be viewed with suspicion, and none is too trifling to warrant the omission of a bacteriologic test. When a test is impracticable, certain clinical manifestations enable us to decide with some certainty.

The question of infection always enters into the discussion of diagnosis, and while the infectiousness of diphtheria can not be questioned, that of allied diseases might. It is, therefore, sound practice always to isolate a case of throat disease which presents an exudate, for clinical as well as bacteriologic tests have proved that they are most always contagious diseases.

Prognosis.—The vigor of the individual is little or no guide as to the likelihood of recovery. When important organs are seriously damaged, the case is more desperate. Paralyses may arise as readily in originally strong as in weaker children. The severity of diphtheria varies considerably in different epidemics, but at any moment septic conditions may arise in even the mildest cases, ending fatally. The earlier the treatment,—it matters little what plan is used,—the better the prognosis. The quantity of membrane is usually, but not always, an index of the severity of the disease. The laryngeal form is liable to be fatal

* Dr. Wm. M. Welch, at the Municipal Hospital of Philadelphia, finds the Klebs-Loeffler bacillus in one-third of all cases of scarlatina.

from mechanical interference with breathing. When diphtheria involves the nose, danger is great, because of the greater vascularity and abundant lymphatic vessels there which readily absorb septic material. Scrofulous children succumb readily to diphtheria, and so do those convalescing from measles. The death-rate of diphtheria was from 40 to 75 per cent., and until recently, despite all efforts to the contrary, this has remained about the same. Half the fatal cases are under five years of age. Since the advent of antitoxin, the mortality records have been reduced materially.

Treatment.—*Prophylaxis.*—The most important point in the treatment of diphtheria is, without doubt, a thorough and widespread popular knowledge of the subject and the possible means of its prevention. This will enable not only the medical adviser to limit the spread of the disease on making its appearance, but elicits the assistance and cooperation of the family and the community. Isolation of the patient should be prompt and complete, and maintained so long as the germs exist in the throat. The time of its disappearance may vary from a few days to, in one reported instance, seven months. One observer has reported several cases in whom the germ persisted for forty days; the average is about fifteen days. Great danger may arise from a very slight case, whether it is recognized or not, and these mild, oftentimes unrecognized, cases are likely to prevail when diphtheria is epidemic. The habit of promiscuously kissing among children is pernicious, and contributes largely to the spread of diphtheria and other infectious diseases. Malignant cases are readily acquired from the simplest ones. All sore throats, when diphtheria is prevalent, should be isolated and carefully treated; all suspicious cases should be examined bacteriologically and the greatest precautions taken, even when the diphtheria bacillus is not found; but where the staphylococcus is demonstrated, every precautionary measure should be employed, whether in families, schools, asylums, or hospital wards, and every suspicious case instantly set apart and guarded. If the disease shows itself in several instances in the same school, thorough hygienic measures should be pursued and the school closed for a sufficient time. In the event of death from diphtheria the body should be wrapped in a sheet soaked in corrosive sublimate solution, and immediately placed in a sealed casket; the funeral should be strictly private.

A patient with diphtheria should be placed in a large room, free from all hangings, rugs, and unessential furniture, and kept quietly in bed. The temperature of this room should not rise

above 68° F., and even in comparatively cold weather free ventilation should be maintained by opening the windows, or those in an adjoining room if drafts are feared. An open fire is of importance for ventilation as well as warmth. In warm weather a lamp burned in a fireplace, to cause an upward current of air, is of value. The bed should be a single one, with opportunity to approach on either side. All discharges from the patient should be thoroughly disinfected. Clean cloths or absorbent cotton are to be used instead of handkerchiefs or towels, or even tissue-paper, and everything promptly burned after using. No one should be allowed in the room except those immediately concerned in the care of the patient, and such persons demand special treatment and strict quarantine. The physician, on entering the room, must be overclothed with garments upon both body and head, which should be disinfected thoroughly. He should also wash his face as well as his hands before leaving the room. The face-guard, such as is described by one of the authors in the "Medical News," 1895, is of value to prevent particles of infection from being coughed into the face—useful both for physician and nurse. Those in constant attendance had better spray their own nostrils and throats several times a day with some cleansing solution. The crowding together of diphtheric patients in the same room or ward is to be deprecated, as it increases the virulence of the disease. Particular attention should be given to the throats and mouths of children, especially to the teeth and tonsils.

Local Applications.—In diphtheria these are of great value, and should be vigorously but carefully employed, though they must be of the blandest, and, of course, omitted in very young children and nervous ones who become alarmed. The objects of local treatment are to remove the toxalbumins and destroy the bacilli, to hasten the separation of false membrane, and afford relief to the dyspnea arising from obstruction in the larynx by the exudate. Local applications are useful: first, as germicides; second, for cleansing purposes; third, to dissolve false membranes; fourth, to allay irritation. They should be applied warm and be nonirritating.

The conclusions of Dr. A. Campbell White in determining how far the outlines of the membrane and the presence of the bacilli are influenced by local measures are as follows: (1) The prompt washing of the air-passages attacked by diphtheria lessens the duration and amount of the diphtheric membrane; (2) antiseptics of sufficient strength to be germicidal are irritating and cause extension and persistence of the false membrane; (3) they

may cause systemic poisoning; (4) spraying, also the pernicious treatment by swabbing, is inefficient, and by young children can not be endured; (5) frequent cleansing of the throat and nostrils with a bland solution, as plain warm water or normal salt solution, is easier of application, more agreeable to the patient, and accomplishes all that can be expected of any antiseptic solution.

Loeffler reports excellent results from the use of his so-called "toluol" solution for the local treatment of diphtheria, and he regards it as sufficient without other specific remedy. He claims a low mortality, general applicability, whether in true diphtheria or mixed infections, and absence of any injurious working, considerable prophylactic action in destroying at once the source for the spread of the disease, and, finally, its cheapness. This solution, as recently modified, is as follows:

Menthol, ... 20 gm. dissolved in toluol sufficient to make 36 c.c.
Absolute alcohol, ... 60 c.c.
Solution of ferric sesquichlorid, 4 c.c.

This is the best for true diphtheria when there is extensive putrefaction, as often occurs in cases of mixed infections.

The ferric solution may be substituted with advantage by 2 or 3 c.c. of creolin or one minim of cresol, absolute alcohol up to 100 c.c. This toluol solution will keep in dark-colored bottles with glass stoppers for months. The method of application is as follows: Superficial mucus being removed by revolving over the membranes a large swab of cotton, a fresh swab carrying the solution is pressed firmly for ten seconds against the affected spot, and this repeated until the whole membrane has been treated. Since it is painful, it must be done thoroughly at the first attempt. This has given good results in the hands of many, used once or twice a day, seeming to check the spread of the membrane, and sequels are rarely observed. It is well to bear in mind that local pains follow the application of Loeffler's solution, but this is less since the addition of the menthol. Guaiacol, applied in the same manner as Loeffler's solution, possesses the same virtues, but has the same defects, causing pain on application. The use of cocain or chloretone previously may alleviate this. A large number of local applications have been recommended, such as peroxid of hydrogen, pyrozone, hydrozone, mild solutions of bichlorid of mercury, etc. Jacobi recommends a spray containing one grain of corrosive sublimate to the pint, adding a dram (℥j) of table salt. Excellent results are claimed by Flick, Judd, and others in the local use of calomel in powder, diluted or of full strength, especially in the nasal form, and where-

ever the membrane can be reached. A number of cases occurring in Flick's own family, as well as in those of his friends, have been most successfully treated by this means, along with the internal administration of calomel in small doses, constantly repeated—$\frac{1}{120}$ to $\frac{1}{40}$ of a grain every fifteen minutes. This he regards as both a local and systemic measure. We have tried this treatment in several cases, with very excellent and prompt effect. Saturated solution of borax and water is also cleansing, but common table salt, one dram to a pint, is more generally accepted. Glycothymoline, diluted 1 : 4, is both cleansing and cooling, and, not being poisonous, can be used copiously.

A solution of boric acid is used by the Germans. Various solvents for the mucous membrane are occasionally applied, such as pancreatin or papayotin, 1 : 20 in water. Trypsin or pepsin, 1 : 20, with hydrochloric acid and glycerin and caroid in powder, have all had their advocates. Any trustworthy cleansing solution will suffice. Applications to the outside of the throat are usually useless to the swollen cervical glands. Lead-water or laudanum, belladonna, ichthyol, or ice-bags, however, assist in relieving pain. Ichthyol, 33 per cent., diluted with lanolin is perhaps the best of external remedial agents, and ranks in value next to cold applications. Vapors of various sorts,—turpentine, eucalyptus, and carbolic acid,—sometimes employed, are of doubtful efficacy. Relief is often obtained by the use of steam generated in a croup kettle, and directed under a sheet arranged like a hood over the patient's head—always to be employed in intubation cases. Steam thus applied favors suppuration, aids in loosening false membrane, and is of special utility in the laryngeal forms. Calomel in powder, diluted or of full strength, especially in the nasal form and wherever the membrane can be reached, is the oldest of the remedies, and has been used since the time of Brettoneau. As a vapor also—calomel fumigation—it is employed in the laryngeal variety. (See Membranous Croup.)

Great care and judgment must be exhibited in the use of the local measures, especially to prevent the patient becoming alarmed or excited, and lest through unskilful manipulation the disease should be induced to spread, or ulcerated or denuded surfaces be thus created, which become avenues for the entrance of the disease elsewhere. Where the nares are nearly occluded by a thick membrane and secretions, they may be cleansed by a cotton swab on the end of a probe dipped in a bland cleansing solution. Irrigation of normal salt solution is better from a fountain syringe with soft-rubber nose-piece, the child wrapped all about with a sheet, to restrain the movements,

lying on its side, face turned down, and a steady, gentle current run into the upper nostril, the solution coming out of the lower nostril by gravity. This may be frequently tried until the solution comes through and out of the lower nostril. Then the child is to be turned on its other side and the process repeated. If irrigation of the nose produces comfort and clears away the obstructions, it serves an admirable purpose. In some cases, where the nostrils are completely occluded, a postnasal syringe may be useful. Care should be taken, however, in practising nasal irrigation that too much force be not used, or the solution may be forced into the Eustachian tubes, giving rise to much pain or great discomfort. Where there is hemorrhage, if slight, little attention need be paid to it, but if severe, astringent solutions may be used—a spray of pyrozone is perhaps the cleanest of local applications, applied to the bleeding point with an atomizer, or, if the spot be seen, on a pledget of cotton.

Constitutional Treatment.—The object of constitutional treatment is to combat the effects of toxins, and the remedies used have been selected either empirically or rationally. It is hardly necessary to review the long array of medicines which have been offered for the purpose of combatting the essential poisons of diphtheria. Some of these still retain the confidence of many wise men and able observers. The internal use of mercury (calomel and corrosive sublimate) has still its stanch advocates; this, with the local use of tincture of chlorid of iron, chlorate of potash, and nascent chlorin, has a surprising hold in the treatment, and is second only to antitoxin.

The internal use of small doses of calomel, as recommended by Flick, certainly deserves respectful attention. Flick gives $\frac{1}{120}$ to $\frac{1}{40}$ of a grain, alone or triturated with a little sugar of milk, every fifteen minutes, combined with the local use of calomel, full strength or triturated one-third, insufflated every hour or two. His results are flattering, and, in the absence of the more rational and efficient remedy, antitoxin, the method deserves a careful trial. In the discussion of his second paper an important point was brought out, namely: That a large proportion of those who rely on antitoxin in the treatment of diphtheria use more or less calomel also in the majority of cases. Judd urges similar measures, and purges his patients once well with the calomel. If serious evidences manifest themselves, destructive changes in the tissues, sepsis, etc., the whole dependence is to be placed on constitutional and nutritive measures and not on any specific agent.

A powerful agency is the hypodermic use of strychnin, in

doses of $\frac{1}{100}$ to $\frac{1}{60}$ of a grain to a one-year-old babe, repeated every three to five hours, as demanded. Feeding should be so full as to be almost forced. Alcoholic stimulants are needed when clearly indicated, but are credited by some of the best clinicians with doing much harm at times. The indications for stimulants are marked prostration, feeble pulse, dicrotism, and a weak first sound of the heart.

Rational treatment should entirely depend upon the condition of each case, and should be employed as the indication may demand, while certain measures, such as disinfection and stimulants, are always in order; the employment of remedies must require judgment, for in this disease it is often a fact that the treatment becomes a routine, and no adequate regard is paid to the symptoms, dangers, or sequels. Because the study of this disease, more than many others, has become the property of the laity, it is often treated at home by the relatives for some time, and when failure results, the physician is sent for and meets the case under deplorable conditions. We think it proper, for convenience, to divide the treatment into different stages, as follows:

First Stage.—The stage of incubation or bacteriologic diphtheria—from the time of exposure to the first appearance of the exudate.

Second Stage.—The stage of invasion—from the time when the exudate first appears to its height.

Third Stage.—The disease proper, where the diagnosis is certain both by clinical manifestations and bacteriologic tests.

Fourth Stage.—The graver features and complications.

Fifth Stage.—The decline—where the disease has pursued a general course, indications pointing to a recovery, the patient's blood assuming immunization.

Sixth Stage.—The sequelæ.

One should be familiar with the disease, so that he can judge for what stage the treatment is indicated. The first and second stages will result favorably, if the recognition is prompt, under any careful method of treatment. It is in the third and fourth stages where the judgment of the physician is tested, and the result ofttimes depends upon his clearness in noting the dangers and how to prevent or cure them. Heart failure can not be remedied, but the knowledge that it is impending should teach one to prevent its occurrence, and by judicious medicaments remove the first symptoms that indicate beginning danger. Again, where diphtheria is seen at the height of the disease, the question may pointedly arise, is the danger diphtheria, toxemia, or septicemia, and it is utterly useless to apply antitoxin in a

septic case if no attention is paid to the septic conditions. If the case is seen in the fifth stage, it is still necessary to apply treatment, for the immunization which the blood of the patient is undergoing may be only partial, and even after a case is regarded as cured reinfection may take place, and the work may have to be repeated. Often has this been seen where a diphtheria of the faucial variety, treated under the old methods and pronounced cured, has returned in a more dangerous form,—the laryngeal,—necessitating intubation and the further use of antitoxin and other treatment. So it must always be understood that diphtheria should be specifically treated, no matter under what conditions it is seen, and no case pronounced cured until the throat is free from the specific bacteria and the patient well of any complicating sequel. It is well to follow, as a general rule, the following method of disinfection:

Disinfection.—When a child has been relieved from imminent suffocation or has received an injection of antitoxin and is placed in a position of relief, choose two rooms in the house, or, if this is impossible, one large room. This being clean and heated, preferably by a stove, remove the child to it without delay. The room vacated should be cleaned at once by burning from four to eight pounds of sulphur in it, previously closing all apertures, permitting everything to remain in it as found, and keeping the room thus closed for from four to six hours. The efficacy of the sulphur vapor can be increased by the generation of a little steam in the room. It is then to be opened, aired, the floor and woodwork scrubbed with soap and water, and afterward washed with sublimate solution, 1 : 2000, thoroughly dried, and the child returned to it, the same procedure repeated in the first apartment. Formaldehyd generated in a thorough manner is as efficacious as sulphur, and is now in general use. The child should be changed from one room to the other day by day, so that while one is occupied the other is undergoing the process of cleansing. Choose a room with a stove, to maintain constant temperature. On the stove place a large kettle filled with boiling water, and, once an hour, a tablespoonful of the following mixture:

Eucalyptol,	℥ij
Acid. carbol.,	℥ij
Ol. terebinth.,	℥xij.

The child should be washed once daily or oftener, and dressed in fresh garments. The nourishment and medicines are to be kept out of the room and only brought in when required. The furnishing is to be the merest necessities—a bed, table, chairs,

and stove. Rigid cleanliness should be enforced and carried out by the nurses. Ventilation should be of the freest, with caution; the temperature of the room should be 68° F. or less, the windows or those in the adjoining room kept open constantly, except in extremely cold weather.

Technic of Applying the Diphtheria Antitoxin.—First, choose the antitoxin. Second, learn accurately its strength. Third, learn how to apply it by carefully estimating the needs of the individual case. It is unnecessary to give an account of the various antitoxins used in America; there are a number of firms who manufacture this in a very satisfactory manner, and they are striving constantly to improve their methods and their products. In the larger cities the boards of health manufacture serums for their own use with the utmost care, most of which have been shown to be of excellent quality.

The strength of the serum is expressed in what are known as immunizing units. This denomination originated with Behring, whose first or normal serum was of such strength that 0.1 c.c. of it would protect against the ten times fatal dose of toxin when simultaneously injected into guinea-pigs. Each cubic centimeter of this normal serum he called an immunizing unit. Later it was shown that the strength of the serum could easily be increased tenfold, so that 1 or 2 c.c. of the serum would protect a guinea-pig against the ten times fatal dose. Each cubic centimeter of this stronger serum was described as an antitoxin unit, and, of course, contained 10 immunizing units. Still later it was shown that the limits were by no means reached, and he succeeded in making serums as much as 300 times the normal strength, each cubic centimeter of which contained 300 immunizing units, or 30 antitoxin units, and at present antitoxin is made of which each cubic centimeter contains 1000 immunizing units.

To apply the antitoxin, first consider the technic of application; then, the dosage. For the purpose of making the injection any hypodermic syringe may be used, if of satisfactory capacity. The one we prefer is a special syringe made for this purpose, with a rubber packing, having a capacity of five cubic centimeters, which can be measured accurately by a screw, so that the quantity to be used may be administered at one injection. This is supplied in a metal case, which allows the whole to be sterilized in boiling water before and after using. A good veterinary hypodermic syringe is satisfactory. Another excellent syringe is made entirely of metal, the plunger fitting snugly, the barrel requiring no packing. The location chosen for the administration is usually in the back, between the scapulæ, on each side

of and near the vertebral column, which, being in a sort of canal, is protected from pressure while the patient is lying on the back; some select the loins or sides of the chest. The skin should be thoroughly cleansed by means of alcohol upon sublimate cotton or gauze. Immediately after the injection the aperture should be closed hermetically with iodoform collodion. The syringe, before each using, should be cleansed thoroughly by means of very hot water. The whole operation should be performed with conscientious aseptic precautions. We have never met with any local trouble due to the injection.

The Action of the Antitoxin.—"Experimental evidence, then, favors the theory that the antitoxin acts through the agency of the living bodies, and probably in the sense that it renders the cells tolerant of the toxin. It is not to be expected, then, that the effects will follow the injection of the serum with the same certainty and precision that is shown in chemic reaction. The cells must be in condition to respond in the proper way. For one reason or another this responsive power may be in abeyance; it may be weakened by intense or prolonged resistance of the diphtheria poison, by other previous or recurring diseases, by inherent weakness, or there may often be some individual idiosyncrasy which hinders the response of the cells to the antitoxin. There is also the possibility that the antitoxin may neutralize the effects of certain toxins and not others present in diphtheria. Antitoxic serum exerts no bactericidal effects upon the diphtheria bacilli, though when administered in sufficient quantity early in the disease, it arrests the spread of the disease, which is caused by the bacilli" (Wm. H. Welch).

Administration and Dosage of Antitoxin.—A large aggregate experience with antitoxin has led to clearly defined and simple rules for its administration. A clearer conception of the therapeutic indications for the remedy and the recognition that there are few or no dangerous after-effects, and but few and rare disagreeable results following an injection of antitoxic serum in doses ranging from 1000 to 3000 immunizing units (4000 to 5000 units in very severe cases), have led to the employment of larger and still larger doses; and, where repetition is found needful, at much shorter intervals than were first recommended.

The importance of inaugurating serum treatment early, recognized from the first, has grown more emphatic by accumulating evidence. All statistics show that the earlier in the course of the disease antitoxin treatment, or any other treatment, is begun, the better are the results. The mortality in cases so treated, when the disease is in its incipiency or has just established itself,

is very small (about 10 to 15 per cent.), and in cases treated late, say from five to eight days, may range as high as 30 or 40 per cent. The number of days the disease has apparently progressed is no absolutely reliable criterion of the stage of development in the individual case. This applies especially to the formative period, when the disease is frequently more or less masked, and constitutes one of the several reasons why antitoxin treatment should be instituted at once in all cases which excite suspicion. In the clinical management of all such cases, and of all acute anginas, even remotely simulating diphtheria, a full curative dose of antitoxin is the means of gaining much valuable time and the saving of many lives.

Bacteriologic examinations are of totally inadequate clinical value if the serum injection is delayed to secure a report, since too much time is thereby lost in instituting specific treatment. Furthermore, such examinations are not conclusive independent of the clinical manifestations of the disease; and, again, the great majority of suspicious cases showing negative results in the laboratory yield with equal promptitude to the serum treatment.

Antitoxin treatment, however, is of value, even when given late, especially in the laryngeal variety. A thoroughly reliable serum administered at almost any period of the disease, will lessen the average mortality; it must be accepted, however, as a therapeutic axiom that the further the disease has progressed, the greater is the urgency for a large initial dose and the necessity for repetition of the dose at short intervals—once, twice, or oftener in the twenty-four hours, according to the severity of the case.

To be adequate, a curative dose of antitoxic serum must contain enough immunizing units to neutralize perfectly the specific toxins present in the system. When this is done, the system is rendered immune to any further development of the Klebs-Loeffler bacilli, and the disease is arrested. If the initial dose fails to accomplish this, the disease progresses in proportion to the degree in which the dose has fallen short, or no effect at all may be produced. The repetition of the dose or its increase is then instantly indicated, and the shorter time which elapses before such repetition is made, the better will be the results.

The exact therapeutic indication, as far as concerns the number of immunizing units which should be administered in any given case, can not be determined, since there is no possible means of estimating the quantity and virulence of the absorbed toxins; hence the imperative need of a sufficiently large initial dose.

Doses should invariably be estimated in immunizing units and not in quantity of serum, since the latter is only the vehicle. The most concentrated serum—that which contains the largest number of units in a cubic centimeter—is the most desirable product to employ, because of the small bulk of the dose, diminished irritation, its prompt absorption, speedy effects, and larger percentage of cures.

Immunizing doses for healthy persons who are exposed to the contagion need seldom exceed 500 units in adults, and 200 or 300 units for children, depending upon circumstances, degree of exposure, etc., and are operative for about one month; three weeks is the minimum.

The fear once attending the administration of immunizing doses to any but the most robust children has been found groundless by Morrill's earlier experience in the Boston City Hospital, as well as by many others. Behring's rule is to give 100 units to an individual of about 120 pounds bodily weight. Rosenthal gave 600 units to a pregnant mother then in charge of her child suffering from diphtheria. She was subsequently confined in the same room without evil effects. He now gives to each person where exposure is constant 500 units, and if the bacteriologic test shows the presence of the specific bacilli, the case belonging to the first stage, a full curative dose of 1000 units is invariably given.

A curative dose should be 1000 immunizing units, and may, if the conditions are imperative, be as high as 3000 or 4000 units as an initial dose. The age of two years should be the dividing line, below that, 1000 units are sufficient; above that, 1500 to 2000 units. This dose of 1000 units is frequently sufficient for cases seen early, in the second stage or the first day of the second stage. In well-developed cases showing more or less malignancy, in laryngeal cases, and in the nasal variety, no less than 2000 units should be given as an initial dose; this should be repeated in six, twelve, or twenty-four hours. The repetition should be in increasing quantities. Thus, if the initial dose is 1000 units and the symptoms are growing worse, the second dose should be 2000 units, the third dose should be 3000 or 4000 units, and so on in increasing quantities until the characteristic reaction is obtained. In serum treatment a safe rule to follow is increasing dosage if the case progresses, and never a smaller dose than the beginning one. Some operators give a large initial dose and repeat the following doses of the same amount (McCallom, W. H. Park, etc.). If these rules are followed, either the large initial dose, repeating

the same dose, or the gradual increasing dosage, very few cases will require more than two doses.

In making the injection the ordinary aseptic precautions are to be taken; this applies to the syringe and the site of the injection. The former is easily prepared by boiling, and the lattter by the use of soap and water, or alcohol soaked on sublimated cotton or gauze. The injection can be made at any point of the body free from pressure—the back, sides of chest, or groins; the interscapular region is to be preferred: the patient can not there witness the act, and will be less apt to experience fright.

As the dose of antitoxin should always be given in units, without regard to quantity, it would be well for manufacturers to have the strength of each cubic centimeter placed conspicuously on the bottle. The contents would hardly be sufficient if it were necessary to divide the dose or otherwise modify the use of the remedy. Therefore each of the bottles should be labeled: 500 units (for immunizing purposes); 1000 units (curative for mild cases); 2000 units (curative for severe cases), etc.

The following rules are offered as regards dose: In the first stage, 1000 units; in the second stage, 2000 units, increasing to 4000 in from twelve to twenty-four hours if the case progresses; in the third stage, 3000 units, increasing possibly to 6000 units in conditions of great urgency; in the fourth stage, 3000 units and 20 c.c. of the antistreptococcic serum may also be used if the case be septic, or 20 c.c. of antipneumonic serum if the specific manifestations show the complication of pneumococcus or streptococcus *; in the fifth stage, 2000 units, and if the symptoms of laryngeal involvement arise, the quantity should be administered in increasing ratio, as in case third.

Clinical Manifestations of the Diphtheria Antitoxic Serum.—Antitoxin is manifested by its—

Effects on Pulse and Circulation.—In the faucial variety antitoxin produces a marked effect in about eight hours, reducing the tension of the pulse and circulation to normal. If it increase again, it is an indication for the use of more antitoxin. In laryngeal cases the pulse-rate remains high throughout, especially in those intubated, and the indication is then for judicious collateral medication.

Effect on the Temperature.—The temperature is most profoundly influenced by the antitoxin in the favorable cases of simple diphtheria; this decline is from any elevation to the normal.

---

* It is a question whether we have as yet any bacterial remedies capable of influencing the poisons of the pneumococcus or the streptococcus.

Effect on Membrane.—On the diphtheric membrane the effect is most marked, limiting its continuance oftentimes to twenty-four hours, forming a separation in from forty-eight to seventy-two hours, when the red line surrounding the membrane is once clearly seen, and over which, Rosenthal asserts, the membrane never spreads. There is then no further need for antitoxin.

Effect on Laryngeal Diphtheria.—(*a*) Cases not requiring operation ; (*b*) intubation cases.

(*a*) When used early in laryngeal diphtheria, it prevents the spread of the membrane, averts asphyxia, and often avoids the necessity of intubation or tracheotomy. (*b*) In intubation cases antitoxin in a great measure prevents the need of intubation or tracheotomy. When intubation is demanded, the time required for wearing the tube is much shortened, and tracheotomy is made unnecessary. The time in which the tube is worn has been reduced from an average of one hundred and eighty-five and one-fourth hours to one hundred and sixteen and one-fourth hours, a reduction of sixty-nine hours.

The Action of the Antitoxin in Limiting the Duration of the Disease.—When administered early in simple diphtheria, all trace of the disease has often vanished on the third day. In the mixed contagion the infection is antagonized and the complications are to be treated without regard to the existence of diphtheria.

In the laryngeal form the stenosis disappears on the third day, unless an operation is demanded. When intubation has been done, the tube may be withdrawn on the fourth or fifth day. In the majority of cases the improvement of the patient begins obviously and at once, thus lessening the probability of complications.

Local applications are only needed for the purpose of cleanliness and for ridding the throat of the specific organisms, which may be a source of danger to others.

Unfortunately, though the power of the antitoxin is great, it is by no means a cure-all, and *complications* may arise demanding prompt and ample attention. Disturbances of the heart, lungs, or kidneys must be treated as they arise, without regard to the precedent diphtheria.

The presence of the bacilli in the throat is not markedly affected by the antitoxin, and these persist long after convalescence, just as in other forms of treatment. It is important to make frequent test cultures to determine this fact.

The Influence of Antitoxin on the Mortality Records.—The mortality records in all large cities are now preserved with such

care that reliable conclusions are to be drawn thence. It has been shown, without peradventure, taking all the various statistics into consideration, that the use of the antitoxic serum has enormously lessened the death-rate.

There remains, then, to consider one important point, the effect of antitoxin upon the various complications. If certain organs have begun to be damaged by the poison, or where they were unsound previously, always difficult to determine, then the disease process may not be stopped by antitoxin. It is more than probable, however, that an early and adequate dose of antitoxin will check or limit the mischief thus begun or emphasized by the diphtheria. It must be borne in mind, too, that by the curative effects of the serum many cases survive to acquire complications, which had otherwise succumbed early. Dana has given a thorough consideration of the subject of diphtheric palsies and the use of antitoxin. His conclusions are that, while the diphtheric palsies are not increased by the use of antitoxin, the fact that they are not much affected nor stopped shows that the antitoxin, however effective as a whole, is not given in sufficient doses to prevent the specific effect of the diphtheria on the nervous tissues. Nevertheless, he admits that while the antidotal action of antitoxin is incomplete so far as the nervous centers are concerned, it is sufficiently powerful in a large number of cases to prevent serious destruction to the organism. Destructive tissue changes are not to be influenced by any specific; we must depend for their removal and repair on rational and constitutional treatment and by meeting the special symptoms as best we can.

Pneumonia is a serious and frequent complication of diphtheria in children. The appearance of the antipneumonic serum gives hope of preventing this, and where the disease has already progressed, of hastening resolution to a favorable termination. Nothing in the way of local treatment will avail in bronchopneumonia following diphtheria. Antiseptic vapors are valueless, as their germicidal properties can not reach the seat of disease in the terminal bronchi and air-cells. Inhalations of oxygen, repeated frequently on demand by symptoms, are useful partly as heart stimulants and partly to reinforce the crippled lung. The use of the cold pack is not to be recommended. Some cases may be benefited thereby, while in others it is very badly borne. Counterirritation with some stimulating liniment containing germicidal properties, as the oil of cinnamon, gaultheria, and eucalyptus, gives some relief. Each case must be treated with a view to preventing rather than to treating this complica-

tion, and while in some the cold pack is of undoubted utility, in others warm poultices act better, while in yet others a liniment with a cotton jacket seems best. The antipneumonic serum, with judicious collateral treatment, offers more hope than any treatment. In intubation cases it is a useful precaution to keep the foot of the bed raised a foot higher than the head, to encourage the draining away of discharges. Drugs to affect the heart as well as temperature are to be used, such as strychnin, caffein, ether, nitroglycerin, alcohol, and digitalis.

Complications and Sequelæ.—The most frequent and by far the most important complications and sequelæ of diphtheria are the various forms of paralyses. These occur much less frequently in children than in adults. Paralytic symptoms may occur early in the disease, but usually come on about the third or fourth week, and are independent of the general condition of the child. (See Neuritis.)

The intensity of the attack of diphtheria is scarcely ever an index of the extent or severity of the paralysis, nor is the severity of the palsy to be inferred from the amount of membrane in any given case, for the milder forms of laryngeal diphtheria are frequently followed by paralytic symptoms, and the proportion varies in different epidemics.

The commonest form of paralysis is that which affects the muscles of the soft palate and the muscles of deglutition; evidence of this form of paralysis is manifested by a nasal intonation of the voice, uncertain speech, dysphagia, and regurgitation of liquids through the nose.

Occasionally we have seen motor paralysis of the ocular muscles, causing strabismus and ptosis, also at times involving the muscles of accommodation.

Less commonly a multiple form of peripheral neuritis occurs. In most cases it begins with the muscles of the palate and those concerned in the act of deglutition, and gradually extends to one or more extremities, the degree of paralysis often varying in different groups of muscles.

The most serious form of palsy is that found in connection with the heart. Heart failure may occur at any time in the attack or during convalescence, owing to the effect of the toxins upon the nerves and the muscle of the heart. (See Myocarditis.)

Albuminuria of diphtheria is not to be regarded as an unfavorable sign unless albumin is found in considerable quantity in the urine and associated with the more malignant forms of the disease.

The most serious complication involving the lungs is bronchopneumonia, as seen in young children.

Pericarditis, endocarditis, and meningitis are rare, and are observed only in septic cases of the severer forms.

TRACHEOTOMY.

This classic operation for the relief of laryngeal stenosis has been slowly superseded by that of intubation, and in diphtheria especially, since the advent of antitoxin, it has been all but abandoned in America.

From being the only clearly indicated and rational procedure, its position became one of uncertainty, and in intubation, as a rival, this hesitation was an unfortunate one, as it seemed to affect the operator, and, in a choice of methods, the easier one being accepted, tracheotomy has been given second place, much to the injustice of its value, and with a plain disregard of definite indications.

For this reason, and while the operation of intubation has become the general one, it is well to always retain the operation of tracheotomy in our list of remedies, and to place it upon a positive footing by briefly enumerating the conditions which may necessitate this operation, maintaining this assertion that intubation and tracheotomy are not rivals in any sense of the word, but are separate and distinct proceedings, which have certain well-defined indications for their special use. The operation of tracheotomy then is indicated:

1. In those accidental cases in which the membranes have been forced down the larynx by attempts at intubation.

2. In those cases where the membranes are too extensive and are not to be reached or relieved by the intubation tubes.

3. In those cases, previously intubated, where there has been a continuous formation of membranes reaching below the tube.

4. In those cases where the membranes have become loosened in the larynx, and where the choice lies between intubation and tracheotomy, the latter is free from danger, for by the introduction of a tube the membranes may be forced down still further into the larynx, causing asphyxia, and then necessitating prompt tracheotomy.

While the operation of tracheotomy means an opening in the trachea, the general term includes all those operations which open the respiratory channel between the thyroid cartilage and the sternum.

When the operation is decided upon, the next point is to elect

the site ; this in a measure depends upon the time devoted to it and the urgency of the case.

When haste is indicated, everything must give way to the rapidity with which relief must be afforded ; hence the isthmus of the thyroid may be divided or a large vein cut, and the hemorrhage may enter the trachea with the air, but this hemorrhage can be checked and such chances must always be taken.

A rule to follow is to make the incision as far down as possible, to tie the isthmus in two places, or clamp the tissues with a hemostat and open the windpipe.

While the operation appears simple to describe and equally simple to perform upon the cadaver, it is a very trying one when circumstances demand haste. In all cases it is well for the surgeon to come prepared for such emergencies. Besides the necessary instruments, a portable electric light with a forehead reflector is a most useful adjunct. The necessary instruments are the knives, scissors, tenacula, hemostats, needles, ligature, retractors, and trachea tubes. Various kinds of tubes are to be had, but even if the tubes are not at hand, improvised retractors will suffice, which can be made of two common hairpins, bent at an angle, while the pointed ends can be fastened to a piece of tape ; the bent crowns can be placed on each side of the openings and thus hold the wound apart, and free access of air admitted. Even if these are not procurable, a stitch can be put on each side of the opening, through skin and tissues, into the trachea, and the long ends made to meet at the back of the patient and then tied. The patient can thus be relieved until a tube is procured.

When operating, the head and neck should be stretched over a pillow or sand-bag. Cocain or chloretone can be used locally, unless the patient is unconscious. An incision in the middle line is made from the cricoid for five or seven centimeters downward. After cutting the skin the muscles are separated, all hemorrhage is stopped, the trachea is steadied and brought forward by means of a tenaculum ; it is then incised by means of a sharp knife, care being taken, first, to cut upward, and, second, to guard against injuring the posterior wall by a sudden cough, due to the ingress of air or blood.

At first there is a violent and irregular respiratory movement, with a sucking-in of air and blood and expulsion of mucus, membranes, or the like, so that care must be at all times exhibited. After the respiration has resumed a more normal quality, attention should be paid to the parts exposed : it may be necessary to enlarge the opening for the removal of shreds or membranes.

If the operation is done secondary to intubation, the technic is the same, but the process is easier, for here the intubation tube may remain in situ and act as a guide during and until the operation is finished.

The after-treatment requires the presence of a trained nurse, and an equal amount of skill and knowledge to perform as the operation itself.

More deaths can be ascribed to the lack of after-treatment than to any defects in methods or conditions. It is for this reason that intubation has become such a favorite and will always be used when possible.

After the patient has been placed in a position of relief, it is well to emphasize the importance or care in the further treatment and what other methods are to be pursued. As the chief danger is caused by the entrance of foreign substances directly into the lungs, and as air unmoistened and too cold acts as an irritant, it is well to keep the room judiciously warmed: a temperature of 80° F. is not too high. The bed should be so arranged that the air can be brought to the child moist and free from deleterious influences.

A measure most valuable and easily applied is to keep some absorbent gauze moistened with a weak solution of bichlorid constantly in contact with the wound and over the opening of the tube. The greatest care should be exercised in the cleanliness of the tubes, and they should be sterilized frequently.

Medicinal treatment should be pursued with the same regularity as regards tonics, stimulants, foods, and the like.

INTUBATION OF THE LARYNX.

In the course of laryngeal diphtheria a growth of the exudate may become so obstructive as to require artificial means to introduce air into the lungs. We are presented with two alternatives: one just described as tracheotomy, by opening the windpipe below the seat of obstruction, and the other, the bloodless operation of intubation, consisting of the introduction of a tube through the mouth into the larynx, passing the seat of obstruction, and maintaining egress and ingress of air through the tube left in place.

For the proper treatment of such conditions it is essential for the operator to be always prepared to be familiar with and to practise either operation, and while he may undertake and perform the operation of intubation, he should at the same moment

be ready to follow this attempt by tracheotomy should the case demand it.

Laryngeal intubation is universally recognized as a life-saving operation, and the honor of its creation belongs to Joseph O'Dwyer, of New York. The history of intubation, like that of every other successful procedure in medicine, bears repetition.

FIG. 41.—METHOD OF FEEDING CHILD AFTER INTUBATION.

Hippocrates attempted intubation by the use of a catheter. In 1857 Loiseau attempted catheterization of the larynx as a treatment for croup, and in 1858 Bouchut devised tubes for permanent catheterization, but his tubes were seldom applied and his method of "tubage" was lost in oblivion.

On May 23, 1888, O'Dwyer ("Proceedings of the Philadelphia County Medical Society," vol. IX, 1888) presented a paper on "Intubation Tubes" and described the different stages traversed by him until he had finished the tubes now in use.

O'Dwyer's creation was absolutely original, and he devised and perfected each tube, with the necessary instruments for their use, and by his matchless ingenuity and untiring energy placed the operation of intubation upon the certain foundation which it now occupies.

O'Dwyer's instruments consist of a set of six tubes, with a like number of obturators, an introducer, an extractor, a mouth gag, and a gage.

The tubes are so shaped that they approximately fit the larynx, being somewhat bulbous at their lower third, and are graded in size by the gage, indicating the ages of those for whom they are to be used. It is essential, however, to take into consideration the size of the child, as frequently a much larger or smaller tube may be required than is indicated by the gage, and thus some judgment should be exercised in the choice of the tube.

It is also well to remember that in certain stages of the disease the parts may be swollen or occluded by a deposit of pseudomembranes and that the safety of the operation may require a much smaller tube than is indicated by age scale, the regular tube being too large for the affected larynx, and accidents often arise by forcing the membranes down into the larynx, causing asphyxia.

It is important in using the O'Dwyer tubes to have them thoroughly cleansed after each using, and, better, regilded, thus preventing any element of contagion; in every new case be certain always to use a new tube. Even should the tube be returned from the gilder and be practically new, it will always be well to cleanse it thoroughly by boiling, for frequently foreign substances adhere to the new tubes. After boiling, dry by passing corrosive cotton through, insert the thread, and then the tube is ready for use.

Method of Introducing an Intubation Tube.—Two assistants are required, neither of whom need be skilful. The child, previously wrapped in a blanket or sheet with its arms covered, is placed on the lap of the one assistant, in a sitting position, so that its legs are held firmly between the assistant's knees. The patient's arms are held firmly to its sides by the hands of the assistant or nurse, in such a way as to steady the trunk, and in no way to interfere with the respiration of the child.

The second assistant stands behind the child, steadies the head,

and holds it in correct position. The proper attitude is thus obtained: the first assistant draws the head up so that the child seems to hang from the top of its head; in this position only is it practicable accurately to introduce the tube, and this attitude should be firmly maintained during its insertion.

The tube, with the silk thread clear and free, is attached to the introducer. The gag is inserted into the left angle of the

FIG. 42.—METHOD OF INTRODUCING THE O'DWYER TUBE IN INTUBATION.

mouth, which is opened as widely as possible, due care being observed to prevent laceration of the soft parts.

The attempt at introduction can now be made, and should be done quickly, and during expiration, for while the attempt is being made there is complete arrest of respiration, and should membranes be dislodged, inspiration may draw them further down into the trachea or bronchi. Several short attempts are always better than a single prolonged one, and should there be a cessation of

respiration or incomplete relief, the tube should be immediately withdrawn and a new attempt may follow. Never use force. Very little power is required, except in cases of subglottic stenosis, where quite a little force is needed to overcome the spasmodic contraction. The index-finger of the left hand is the guide in the act of introduction. This is passed far back into the larynx, then brought forward until the upper border of the cricoid cartilage is felt, directly in front of the epiglottis, which is to be elevated by the tip of the finger. The tube, with the silk thread looped over the little finger of the right hand, is passed along the palmar surface of the index-finger, by which it is guided into the larynx; the handle of the introducer is drawn around so that it stands in the median line. In this way the tube is brought into the correct position, after which it is pushed off the introducer by the trigger attached to the handle, and is simply dropped into the larynx, or the tube may be dislocated from the obturator while removing the latter, and steadied by placing the finger on its head, and, after the removal of the introducer, pressed gently down into the box of the larynx.

When it is certain that the tube is in position and the patient breathes properly, the silk thread is cut and withdrawn, care being taken not to pull the tube along with it. This is done by placing the index-finger again gently upon the head of the tube.

Should there be evidence of loosened membranes, or should the relief be not marked, or if there is any suspicion that the operation is incomplete, as when the tube is introduced into the esophagus, the silk thread should be allowed to remain, especially when prompt extubation is required. It is always well to allow the thread to remain at least twenty or thirty minutes or longer, until the operator is thoroughly satisfied of the completeness of the procedure.

That the tube is correctly placed is evidenced by the previously stridulous or rasping breathing giving way to a hissing breathing sound, followed by a paroxysm of coughing, excited by the irritation of the tube, and by the prompt relief of the dyspnea.

The coughing is an extremely good symptom, and is the most thorough and sure means of getting rid of the accumulating mucus and loosened membranes.

The dangers of intubation are: The crowding-down of the loosened membrane into the larynx, thus causing asphyxia and necessitating prompt tracheotomy; or the making of a false passage by using too much force and working at an angle of the mouth instead of keeping the median line; or producing asphyxia by prolonged or injudicious attempts at introduction.

There are also dangers in performing extubation. The tube may be pushed down into the trachea by too firm a pressure upon the head of the tube of the extractor, or injuries to the soft tissues of the larynx by missing the opening of the tube and dilating the extracting forceps too widely and forcibly withdrawing. Their prevention is self-evident.

After-treatment.—After intubation, as soon as practicable, give the patient something to drink—water, milk, wine, as the case may need. Permit the child to hold the glass or cup and serve itself. Generally the drink causes coughing, and thus mucus and membranes are frequently brought away.

Vomiting very commonly follows intubation, the child by this means attempting to dislodge the tube, and in this it sometimes succeeds, thereby necessitating a repetition of the whole procedure. Care, therefore, must be used, and in the act of coughing or vomiting the child should not be allowed to lie upon its face; nor should it be held over the nurse's shoulder face downward, for in either position very slight exertion might cause it to expel the tube. After a while the child becomes quiet, respiration assumes a more normal character, the pallid lips take on a healthy hue, relief becomes manifest, and a quiet sleep follows.

In cases complicated by grave pulmonary lesions the relief obtained by intubation is but transitory, but life can thus be prolonged so that suitable remedial agents can be administered.

As intubation is simply a means to relieve stenosis, the further treatment follows the same category as is pursued in treating diphtheria.

As is well known, bronchopneumonia is frequently a complication of the laryngeal variety of diphtheria; therefore the further treatment must be rather that of the preventive type. Again, intubated cases are more liable to heart failure, and due care and foresight must be directed to this possibility. It is therefore well, as a routine treatment, to administer cardiac tonic remedies, even if at the time there is no indication for their use. A very useful prescription to be given during intubation consists of tincture of digitalis, combined with strychnin and either the carbonate or aromatic spirit of ammonia, using syrup of tolu as a vehicle. Caffein often acts even better.

While intubated cases frequently get along well enough in their ordinary surroundings, the air being moistened in the natural way before being inspired, it is often necessary to place the patient in a specially moistened atmosphere. An improvised tent can easily be rigged up in any household by means of an umbrella and one or two sheets. (See Fig. 38, Improvised Croup Tent.)

Steam can be led under this canopy from a special croup kettle or from any steam kettle. Such a tent will be found very useful if complications exist or if the case is a prolonged one, necessitating frequent and prolonged intubation. Of far more difficulty is the administration of food, and here the ingenuity of the physician is frequently taxed. In the very young, where nothing but fluids are taken, this is overcome by having the head, in the act of swallowing, placed lower than the body.

This can also be tried in older children, where there is difficulty in swallowing in the sitting position.

Often food is refused in any shape, and water is urgently demanded. It is safe to give any quantity of water, and where there is difficulty in swallowing, small pieces of ice may be taken. Many children subsist for one or two days on nothing else but small pieces of ice. Frequently it is found that semisolids are swallowed more easily than liquids; then may be given corn-starch, wine-jelly, oatmeal gruel, eggs, and the like.

The entrance of food into the bronchi through the tube is a danger that does not exist, as has been conclusively proved by postmortem observations of Northrup, Holt, Rosenthal, and others.

External applications to the neck are often indicated, and, when required, are grateful to the patient; of these the cold pack, or ice poultice, stands first. Ice can be applied to the neck by means of an ice-bag or a sausage casing. Sometimes warmth is more agreeable.

The indications for the operation of intubation are, in the main, the same as those for tracheotomy. The most pressing indication is the appearance of recession in those parts of the chest which yield to external air pressure, with continued restlessness, due to insufficient oxygenation as well as feebleness of respiration. In cases of secondary involvement of the larynx, where the patient is more exhausted by reason of the coexisting toxemia, intubation should be performed at once, even before the urgent symptoms of stenosis are manifest.

The advantages of intubation are: (1) The speed with which it can be performed; (2) bloodlessness; (3) absence of shock following; (4) it can be done any time, day or night; (5) no need of anesthesia or other preparations; (6) no wound is made, thus the spreading of infection is avoided; (7) there is no objection on the part of the parents; (8) the inspired air enters the lung naturally warmed and moistened; (9) the subsequent care does not require skilled attendants.

The disadvantages are: (1) It clouds the prognosis; (2)

induces a tendency to heart failure; (3) its dangers—(*a*) pushing down false membranes and (*b*) suffocation by finger or attempts to intubate; (4) difficulty in nourishing patients.

Prolonged Use of the Tube.—It may sometimes happen that on the removal of the tube the case may not have fully recovered, and reintubation be necessary; this may take place at once, usually within the first twenty-four hours, and in some instances not until a week has elapsed. When the reintubation is necessary at once, it is an indication that the exudate is still present, and the patient is still suffering from the primary disease. But when intubation is required after a number of days of extubation other reasons must be sought, and if found, remedied. By the prolonged use of the tube is meant those cases requiring the tube after the specific bacilli have disappeared, or where there is no longer any appearance of the membrane.

A tube is no longer necessary if the child can breathe without it, and three weeks should be the longest time that a normal case of diphtheria should continue. After this time other causes exist, and these may be: First and foremost, paralysis of the vocal cord on either side; second, edema of the tissues; third, ulceration of the cricoid cartilage, with consequent collapse; fourth, cicatricial contractions and exuberent granulations, following ulcerations and paralysis; fifth, traumatism and its results, injuries inflicted by the passage of the tubes in or out; sixth, a too tightly fitting tube; seventh, leaving the tube in too long.

The treatment varies with the case: The first indication is collateral treatment—the large dosage of strychnin, with food and stimulants; second, the use of gentle local medication; third, the frequent extubation of the tube, with intubation of one slightly smaller. In cases where the smaller tube is used care must always be taken that the physician or assistant is near at hand, for the patient may frequently extubate by expectoration, and death has been noted from this alone. Fourth, see Tracheotomy.

Removal of the Tube.—Extubation is more difficult than the act of intubation. The patient and assistants are arranged in precisely the same way as in primary operation. The index-finger of the left hand acts as guide for the extractor, the epiglottis is elevated, the point of the extractor enters the opening of the tube, the lever is pressed, the jaws are separated, and the tube is withdrawn in the same direction as it was inserted.

When to Extubate.—The advent of antitoxin has placed the length of intubation on a more definite basis. It is safe to assume that attempts at extubation should be made on the fourth or fifth day. If the tube is withdrawn and stenosis relieved for

from four to six hours, it is safe to conclude that intubation is no longer required. We should always be prepared to perform an immediate secondary intubation, so another tube should be prepared ready at hand before extubating. It is well to have the patient abstain from food for a few hours before extubation, and to give a stimulant immediately before the operation. After extubation further treatment of the patient will be required for two or three days, or until convalescence is firmly established.

SCARLET FEVER.

Synonym.—SCARLATINA.

Scarlet fever is an acute specific disease, self-limited and very contagious, characterized by sudden onset, vomiting, sore throat, and oftentimes convulsions, and accompanied by a high temperature and the appearance of a diffuse, punctiform, scarlet rash, appearing first about the neck and shoulders. One attack protects from others, with rare exceptions. It occurs in epidemics, more commonly in the autumn and winter, but it is constantly endemic in populous cities. Some unexplainable reason would seem at certain times to favor the propagation of scarlet fever, causing those who have escaped previously to yield to the poison. The usual complications are membranous inflammation of the pharynx, frequently extending to the nose and ear and occasionally to the larynx. The sequelæ have chiefly to do with changes in the kidney and middle ear. McCallom says that nephritis, pneumonia, pericarditis, endocarditis, dilatation of the heart, otitis media, and streptococcus-infection must be considered integral parts of the scarlatinal process.

Causes.—A specific micro-organism has long been suspected to be the cause of scarlatina, but no one has been hitherto generally accepted as proved, though the complications exhibit the effect of the streptococcus pyogenes along with, oftentimes, other pyogenic germs.* The infection enters the system most com-

* Dr. Wm. J. Class, of Chicago, has only recently demonstrated the constant presence of a micro-organism, and Dr. Gradwohl has confirmed his observation. We quote from a letter from the latter to us while the work is in press: "In answer to your question as to the probability of the diplococcus scarlatinæ (Class-Gradwohl) being the essential cause of scarlet fever, I will make this statement: when we take into consideration the number of cases of scarlet fever in which this micro-organism was found, by both Dr. Class and myself, in the blood, in the throat, in the scales, and in the urine of these patients; when we consider that it produces a scaly eruption in swine and also an acute nephritis in guinea-pigs and swine; that it kills mice; that it can be recovered from these animals at the postmortem examination—I think I am justified in calling it the true etiologic agent at fault in the production of scarlet fever."

monly through the nose or throat. It is by some regarded as a local disease of the throat, followed by constitutional symptoms. The severity of the angina does seem to be an index of the general disturbance.

Predisposition plays an important rôle, individuals varying widely in this particular and the same persons at different times. Certain persons constantly exposed escape, and long afterward may contract the disease. Scarlatina attacks the most vigorous as readily as those of feeble constitution. Age is a potent factor in the propagation and mortality. Babes under six months rarely contract the disease, but those above one year readily do so, and among them the mortality is high. Incubation is from two to five days, more or less, but is rarely over a week. A short incubation presumes a severe case. The infection is not so readily transmitted as measles, but is exceedingly tenacious. Almost any object coming in contact with the sufferer from scarlatina may retain and convey it, especially those which have been much handled,—domestic animals, pets, flowers, books, clothing, etc., are convenient vehicles,—and, indeed, almost any object may be the medium of contagion. The morbific principle remains active for months and even years. No age nor race is exempt. The exact origin of any outbreak is hence most difficult to trace. Milk is a recognized agent. It is pointed out by H. A. Hall that scarlatina occurs in epidemic form chiefly in countries or places where cow's milk is an article of diet, and is absent where this is not used. The secretions of the patient are the most dangerous sources of infection, in particular those from the mucous membrane and from the skin, and especially during the stage of desquamation. This last is denied by some, but can not be practically ignored. During incubation the patient is scarcely able to communicate the disease, but as soon as the rash appears he is a source of danger, and more so when the disease is at its height and long after, indeed, until full recovery, not only from the febrile process, but from the protracted desquamation and while any catarrhal or suppurative output continues. The feces and urine are to be feared, especially when there is nephritis or diarrhea during convalescence. Quarantine should be maintained until the child is completely recovered from the disease and the mucous membranes and skin show no trace of disturbances.

The skin-lesion consists of a hyperemia, with dilatation of superficial vessels and infiltration about the sweat-glands. There are destruction of the lining epithelium, a filling of the lumen with granular detritus, and death of the epiderm, which is cast off during desquamation.

Symptoms.—The premonitory symptoms of scarlatina are sometimes absent, but are usually severe, and consist of vomiting, chills, fever, convulsions, angina, etc., and constitute in some sense an index of the severity of the attack and are promptly followed inside of a day or a day and a half by the rash. In a large majority of cases the disease arises suddenly. In serious cases the fever rises abruptly to 104° to 105° F. (40° to 40.5° C.), rarely less than 101° F. (38.3° C.), even in the mildest. The pharynx will early exhibit some soreness, but there may be no objective appearances, yet usually there is a marked redness over the fauces and tonsils, consisting of a uniform blush or a series of small punctate spots less marked than in measles; at other times the throat resembles follicular tonsillitis or even a well-marked attack of diphtheria. These throat symptoms are not always obvious at first; more commonly they show a little later in the disease,—two or three days,—and tend to increase in severity to the point of much distress and greatly puzzle the physician. Diphtheria is suspected, but bacteriologic study seldom reveals the Klebs-Loeffler bacillus—more commonly the streptococcus. Well-marked instances of the mixed infection are, however, recognized. The deep cervical glands are usually enlarged or soon become so.

The enlargement of the superficial lymphatic glands is a marked feature of scarlet fever. It is present to a more or less marked degree in many of the infectious diseases, and is especially prominent in diphtheria, rubeola, and scarlatina, and may be merely a characteristic phenomenon of these disorders. Adenitis is more commonly found among children than in adults. In scarlet fever the adenitis occurs from the first, and is more marked in the earlier stages, and subsides slowly toward the end of the attack. The enlargement of the glands about the jaw and neck is more or less proportionate to the intensity of the throat involvement. The maxillary glands are the ones which most frequently suppurate. In the adenopathy of diphtheria there is a wider variation and a greater lack of uniformity than in that of scarlatina. "As a diagnostic aid in differentiating the rashes of diphtheria from scarlatina, a well-marked enlargement of all the superficial glands, especially the epitrochlear and axillary, would, in doubtful cases, I think, lead one to throw the balance in favor of scarlatina" (Schamberg).

In scarlatina all the lymphatic structures of the body are hypertrophied, and there is a hyperplasia of the lymphoid tissue of the spleen, liver, and intestines. Patients with high temperatures and well-marked eruptions are apt to have a more

marked adenopathy than those with but little fever and poorly marked rashes.

The urine is generally lessened in amount and of higher specific gravity, deeper color, and frequently shows traces of albumin. After three or five days all these symptoms subside, as a rule, and the child becomes bright and active once more, unless some complication impairs its vigor. It is imperative to keep it in bed, however, as exposure to chill at this stage is exceedingly perilous and liable to be followed by serious organic disturbance.

The tongue of scarlatina has been described as typically like a strawberry, that of measles like a raspberry. It is difficult to find such simple, graphic pictures, however, nor do they help materially in diagnosis. A most important and characteristic symptom of scarlet fever is the enlargement of the fungiform papillæ at the tip and edges of the tongue. This may be slight and overlooked, but it is constantly present. There are two varieties of this: in one the papillæ have the appearance of small grains of Cayenne pepper sprinkled on the tongue; in the other the papillæ protrude like little buttons, much elevated, but not deeply red. The "strawberry tongue" is an exaggeration of this condition. This symptom appears very early in the disease and may continue for twenty or thirty days.

After the first evidence of disturbance the rash may appear in half a day to a day and a half, or even as late as the fifth, usually beginning about the neck and chest. It may come and go and at first escape attention, and continue from three days to a week. In an epidemic we observed and reported, occurring in the Children's Hospital in 1878, of eleven cases, in none the rash lasted over a week, and in one only a single day. The color is distinctly characteristic, a bright scarlet, resembling Rötheln, and not the crimson of measles, which is more purplish in tone. Color alone is a significant guide to one of keen color-sense, but since one man in ten is bereft of this, and few men (though all women) possess the faculty, this depending for a decision upon comparisons of shades and tones is too often only a following of precedent, and not the product of observation. There are many irregularities in appearance and extent of the erythema: it may be absent altogether, or appear transiently one place to-day, another to-morrow, or may cover the patient from head to heel.

The rash of scarlet fever is a punctate erythema. The color is difficult of word depiction. It is frequently described as of a bright scarlet or boiled lobster tint. By actual color comparison at the bedside such a characterization is seen

to be inaccurate. The color, to be sure, varies within certain limitations in different patients. It is a bright or dull red, usually the latter, with an appreciable element of brown and blue. Upon close inspection the rash is seen to be made up of small, deep-red puncta, surrounded by erythematous areolæ of a somewhat brighter hue. When these areolæ coalesce, as is usually the case, a diffuse eruption is presented. At times, however, there is some intervening normal skin, giving the eruption a more or less speckled appearance. This is not infrequently noted upon the flexor surfaces of the forearms, in which region the efflorescence may be so blotchy as to excite a suspicion of measles. In most well-marked eruptions, and occasionally in mild ones, there are visible numerous pinpoint to pinhead-sized vesicles, with turbid contents. These are for the most part distributed discretely over the abdomen, chest, and, to a lesser extent, upon the extremities. At times they are closely aggregated in clusters, and may even coalesce, with the production of blebs. In rare cases the vesicular element of the eruption of scarlet fever may be so marked as to deceive the physician as to the true nature of the rash. Goose-flesh papules of the normal skin tint, located at the site of the hair follicles, may be present in large numbers in some cases. The favorite situation is the lateral aspects of the abdomen.

The rash of scarlet fever begins upon the neck, clavicular region, and chest, spreading thence over the trunk and extremities. When the face is typically involved, a characteristic picture is presented. The eruption is limited to the forehead and cheeks, being often heightened in the latter region by a dusky red or violaceous flush; the upper and lower lips are exempt, their pallor strongly contrasting with the surrounding rash.

The rash of scarlet fever varies greatly in intensity, at times being so slight and transitory as to be scarcely recognized, at other times being so intense as to be accompanied by swelling of the cutis and exaggeration of the natural furrows of the skin, or by hemorrhage into its structure.

The eruption fades in from two to eight days, and is followed by desquamation. This usually commences upon the fifth or sixth day, and may continue for six or seven weeks. Scaling begins in the region on which the rash has first appeared, and preserves the sequence of the progression of the rash. Upon the trunk it is first seen as powdery scaly points at the summits of the desiccated miliary vesicles. These increase in size by raising the surrounding horny layer until a small "collarette" or jagged ring of desquamation is formed. Neighboring rings soon meet,

forming patches of a gyrate or geographic outline. Upon the flexor surfaces of the hands and feet, owing to the thickness of the epidermis in these regions, the skin desquamates in lamellæ or strips of considerable size, and, indeed, in rare cases may be exfoliated as an entire epidermal cast of the member. The amount of desquamation is, as a rule, proportionate to the intensity of the eruption. In very mild rashes, therefore, scaling may only be visible upon close scrutiny of the skin.

When at the height, too, sometimes the rash recedes,—"strikes in,"—producing a disturbance in the minds of the family and friends. This is rarely a cause for anxiety; it may, however, indicate lowered vascular tension, weakened heart action, and is usually restored, both the rash and cardiac action, by a hot bath or pack. Secondary rashes indicate grave conditions and deserve further study. The rash is sometimes nodular or papular, causing an appearance like "goose-flesh," or vesicular. It may come and go intermittently; urticaria may coexist; occasionally minute hemorrhages appear on the surface, causing an appearance of "blackness" or, rather, a deep purple; this is common in malignant cases, but is not constant. Congestive states or inflammatory disturbances of internal organs have a tendency to modify the character of the rash, lessening it, as a rule.

Itching is sometimes annoying, but not so intense as in measles. As the rash develops, other symptoms increase and then lessen with its subsidence. As the rash fades, desquamation sets in; this consists of an exfoliation of dead epithelium, and the form is characteristic. If the surface has been anointed by soothing applications and regularly bathed, this is far less conspicuous or prolonged.

It is a common experience in dispensaries, and occasionally in private practice, to meet cases of the various complications—nephritis, otitis, and the like—in whom the disease has not been recognized at all until these later disorders arise. In our outpatient service we have seen many such. The mere appearance of this peculiar form of desquamation is practical proof of preexistent scarlatina. Cases vary from the **mildest**, wherein the temperature is not above 101° F. to 102° F. (38.3° to 38.8° C.), a fugitive rash, slight pharyngitis, all subsiding in three or four days, to those of **moderate severity**, sharp prodromes, and well-marked symptoms, temperature 105° F. (40.5° C.), "boiled lobster" rash, longer duration five to seven days; and, finally, **malignant cases**, with short incubation, intense initial symptoms, early and full exanthem, higher and longer fever, severe and varied complications, intense angina, congestion and ulcera-

tion, sores on lips and teeth, cervical lymphadenitis with brawny cellulitis, fetid nasopharyngeal catarrh, and general septic symptoms. In these cases the temperature leaps up and remains high for a week or ten days.* We had a notable case, a boy of twelve, presenting all these phenomena, until the dyspnea and heart failure compelled us to abandon hope; the urine was loaded with albumin and growing scanty. Suddenly the urine became loaded also with uric acid crystals (which was beyond all previous or later experience in acid urines), and continued thus for two days, during and after which all the danger-signals were lowered and the boy made a perfect recovery, and to-day, fifteen years later, is apparently in perfect health.

In severe epidemics there are met with rare instances of sudden overwhelming severity, "fulminating," or lightning cases, in whom death takes place before the recognizable symptoms declare themselves. There are usually evidences of cerebral disturbance,—vomiting, convulsions, headache, and the like,—followed quickly by evidences of organic failure and it may be of hyperpyrexia (107° F.—41.6° C.).

The heart should be carefully examined. Sometimes endocardial murmurs are heard, disappearing entirely. Endocarditis or pericarditis occasionally arises alone, or in connection with other complications. The lungs are not often affected, but bronchitis, bronchopneumonia, or pneumonia is present at times.

Surgical scarlatina is a curious condition not well understood, wherein after slight or other operation scarlatina becomes inoculated. This is usually from accidental exposure in one not protected by a previous attack. The operation seems to render the subject peculiarly susceptible. This form of scarlatina is generally atypic: short incubation, noncharacteristic rash, irregular but severe nervous phenomena, are common. Some observers deny that these manifestations are aught else than peculiar forms

* McCallom distinguishes five types of scarlatina: (1) Temperature, very small rise, perhaps one degree; no eruption on the body or only a transient erythema, but seen slightly in the throat, which is congested; some dysphagia, hands dry and hard. The diagnosis is based on the enlargement of the papillæ at the tip and edge of the tongue, a constant feature in all his 1000 cases. From these mild cases, often unrecognized, much infection is derived, and among them organic disease often arises. (2) An eruption, characteristic but brilliant, more marked in the axillæ and inguinal regions; subjective throat symptoms not prominent; temperature from 99° to 100° F. (3) High temperature for three or four days, and brilliant rash; throat symptoms well marked but not conspicuous; no nasal discharge. (4) Moderately high temperature—102° to 103° F.; marked throat symptoms and profuse nasal discharge, in which streptococci are found; enlargement of the cervical glands occasionally observed. The temperature remained elevated for from ten to fourteen days, and came down by lysis. The patients were mildly delirious or in a semiconscious state, the eruption in most cases brilliant, but in some instances extremely pale.

of septicemia, but it is demonstrated that from them scarlatina is often spread, and that the sequelæ common to this disease follow, such as nephritis and otitis.

The urine in scarlatina is generally lessened in amount, of higher specific gravity and of a deeper color, frequently showing traces of albumin.* As a rule, all these symptoms subside after three to five days, and the child becomes bright and active once more, unless some complication impairs its vigor. It is imperative to keep the child yet a while in bed, as exposure now is exceedingly perilous, and it is at just such times that future disastrous happenings are begun.

The kidneys are, next to the throat, most commonly affected —in the milder cases only temporarily, by the appearance of febrile albuminuria, which is, according to Delafield, an acute degeneration of the kidneys, direct irritation of the epithelium of the tubules by the toxin eliminated by the kidneys. The microscope shows a granular degeneration and death of the epithelium of the tubules. It is the appearance known as "cloudy swelling." This condition entirely clears up upon the recovery of the patient, and calls for no further treatment than a continuance of fluid diet. Pronounced lessening of the amount of urine is of grave import.

Bauer and Deutsch, studying the condition of the stomach in the infectious fevers, found in scarlatina that the free hydrochloric acid is usually absent until after the temperature had fallen to normal for six or seven days, though in some cases it was present at the beginning of the fever, absorption being augmented somewhat, the mobility remaining normal.

Slight transient paralyses have been noted (Meyer, Alexieff).

Diagnosis.—It is often exceedingly difficult to be absolutely certain of the diagnosis of scarlatina in less than two or three days or until the later phenomena appear. Notwithstanding the clear picture ordinarily exhibited of the short incubation, vomiting of onset, sudden and marked rise of temperature to 100.5° or 103° F., early appearance of erythema and angina, pronounced constitutional symptoms and early appearance of albuminuria, etc., nevertheless there are other conditions which present most of these features at times. The enlargement of the papillæ

* According to McCallom, 39 per cent. of cases showed the slightest possible trace of albumin in 1000 cases, a very slight trace in 4.5 per cent., a slight trace in 9.3 per cent., a trace in 6.8 per cent., a large trace in 2.7 per cent. In five cases the albumin was one-half of one per cent., and three of these died. A few patients who recovered had complete suppression of urine for a short time. In only three cases was the acute renal trouble followed by chronic disease.

at the tip and edges of the tongue is said by McCallom to be sufficient to base a diagnosis on in the absence of erythema or rash. The chief difficulties lie in the irregularities in the distribution and character of the eruption, whereas a typical scarlatiniform rash is occasionally due to other diseases,—influenza, Rötheln, diphtheria,—and also to the ingestion of certain drugs. The diagnosis of a typical scarlatinal rash presents few difficulties, but the atypical forms are most perplexing. Certain forms of antitoxin rash are markedly like scarlatina. Subjective throat symptoms are frequent, but not constant enough on which to base an opinion. Objective throat symptoms are always to be discovered, and are a great aid in diagnosis. "The appearance of a punctate eruption in the axillæ and groins, with congestion of the tonsils and a punctate eruption on the roof of the mouth, no matter whether there is any eruption anywhere else or not, are positive proofs of scarlet fever" (McCallom).

To make a diagnosis after the eruption has faded or changed is often most important. A white line at the junction of the pulp of the finger with the nail, showing the commencement of desquamation, is of great significance.

Complications.—The most prominent complications of scarlatina are observed in the throat. There is almost always present, as a constant factor, an erythematous blush, somewhat punctate, spread over the mucous membrane, hard palate, and upon the tonsils, which are swollen, and small, membranous-looking exudates are seen on them, which are easily wiped off. When this symptom is severe, the appearances closely resemble diphtheria: so much so that many yet regard this state as a combination of the two diseases, but it is proved by bacteriologic studies to be due to the streptococcus, and only very rarely to the Klebs-Loeffler bacillus (pseudodiphtheria). Late in the disease, after the subsidence of the primary fever, true diphtheria may also coexist. The scarlet fever patient is particularly susceptible to diphtheria, but the diphtheria patient is not susceptible to scarlatina.

Should this membranous condition, from whatsoever cause, become severe, the local dangers are from extension along the mucous membrane of the nasopharynx and Eustachian tube to the middle ear. Swallowing is made difficult and painful; the breath is fetid; irritating discharges exude from the nose and throat; respiration is impeded, and the larynx is so narrowed by obstructing membranes as to imperil life directly. Along with this the glands of the neck are invaded, a dense cellulitis is set up, often extending from ear to ear. Constitutional symptoms

are severe, too, owing to streptococcus toxemia or to suppuration in the glands, pneumonia, or nephritis. In the very worst cases gangrene may set in, causing extensive loss of tissue, or, along with a profound increase of the aforesaid symptoms, the membranes become darker and dirtier looking, sloughing takes place, often extensive, involving the blood-vessels, and fatal hemorrhage may result.

The accompanying constitutional features are shown by increments of intensity of all bad symptoms, profound asthenia and cachexia, with little or no tendency to repair.

The cervical lymph-nodes are swollen in almost all cases, especially when accompanied by severe throat trouble, which may remain as merely an acute inflammation or proceed to suppuration. A cellulitis of the neck may accompany, especially toward the end of the first week. This should be relieved early by free incision, or it may extend to the deep tissues and involve the blood-vessels, hence producing hemorrhages. A marked leukocytosis is usually found when suppuration sets in.

The ears, so commonly involved in scarlatina, are affected by extension along the Eustachian tube from inflammation in the throat. It occurs in younger children, and varies with the character of the epidemic, yet in some severe ones the feature is often rare. Otitis arises at the height of the disease or during convalescence. There may then be pain, high fever, and recognizable deafness, or otitis may be accompanied by no special subjective symptom, and only give evidence by pyemic states or meningitis. The exceptional rise in fever which usually accompanies this falls promptly when the drum ruptures.

The *treatment* of painful conditions of the ear is heat, preferably dry, as from a hot-water bag, hot salt, bran, brick, or soapstone, the child's head to be laid on this, a thin pillow intervening. Prolonged poulticing encourages suppuration, hence should not be practised. A small object, like a glove-finger, filled with hot salt and gently placed in the ear, gives comfort. One should never drop oil or laudanum in the ear of a child. Blood-letting by leeches is valuable in those not too young or too weak. After these means are used, opium may be tried cautiously for the relief of pain. Should the pain continue or increase and the temperature remain high, or if cerebral symptoms are added, operation is called for. It is not a difficult thing to make a puncture into the ear-drum, and should be done when indicated. This will relieve tension and pain and let out a little blood; thus the formation of pus is possibly prevented and much suffering avoided. Later, operation may be demanded to let out pus and

to prevent extension of inflammation to the bony parts, but this is better done by a skilled aurist. When the drum is incised or ruptured, the discharge should be carefully and persistently cleaned away. This is best done by a soft-rubber ear syringe and a warm lotion (85° or 90° F.) of saturated solution of boric acid, normal salt solution, or bichlorid, 1 : 5000, and, if abundant, repeated every two or three hours, or at least several times a day. Use no cotton covering nor plugging. To dislodge accumulations of pus peroxid of hydrogen is useful, alone or diluted. (See chapter on Diseases of the Ear.) The nose should be cleansed, too, regularly, by atomizer in an older child or dropping-tube in infants, using Dobell's or Seiler's or other alkaline antiseptic solution, warmed.

The nervous system is rarely affected in scarlatina further than is shown by the convulsions and vomiting of onset. Meningitis may follow severe otitis, by extension. The digestive organs are disturbed, as in other febrile processes. The vomiting of onset is rather an evidence of systemic poisoning than a local disorder, or it may point to cerebral complications. Its occurrence late in the disease may evidence uremia. The tongue exhibits a peculiar coating, which clears off in a characteristic manner, giving rise to the so-called strawberry appearance. In typical cases there is usually a rapid rise in temperature, 103° to 105° F. (39.4° to 40.5° C.), even in the mildest above 100° F. (37.7° C.), and along with this is an increase in force and frequency of the pulse (from 120 to 150 beats) in excess of what the state of the child would apparently warrant. Among the other complications which are occasionally met with in scarlatina may be mentioned hyperpyrexia, endocarditis, pericarditis, pneumonia, suppuration of the lymphatic glands, ophthalmia, and a peculiar form of arthritis which closely resembles rheumatism.

The influence of the scarlatinal poison on the heart is a very marked one. Mitral systolic murmurs are most common; a "bruit de galop" is occasionally heard; irregularity of the heart action is not uncommon. Endocarditis and pericarditis are occasionally met. The area of dullness is often increased; rapid dilatation also sometimes occurs. Transitory murmurs are often heard. The heart muscle loses its tone, and is unable to contract sufficiently to close the valves tightly, and from this condition the murmur may come.

Second attacks of scarlatina are not very rare. Relapses occur somewhat rarely, and must be distinguished from reinfections. A true relapse shows itself in from thirty-five to forty days after the disappearance of the exanthem (McCallom), and

would be ushered in by the usual symptoms of the disease. A pseudo-relapse or reversio eruptionis takes place just after the disappearance of the exanthem. A reinfection may take place in about fifty days after the eruption has faded, and is not accompanied by very violent symptoms, as a rule, though death may result.

Prognosis.—The prognosis in scarlet fever is favorable when cases are carefully isolated and judiciously treated from the start. The severity of the infection varies widely in different epidemics, and in different years under somewhat similar circumstances, from a fraction of 1 per cent. to 25 per cent. or more. In all mild cases, especially with marked albuminuria, the prognosis should be guarded. The kidneys may suddenly cease to act, whereas they had showed previously no evidences of deficient or disordered function. Profuse diarrhea is always a grave symptom. The hemorrhagic form is very serious. Streptococcus-infection plays an important role in the fatal result.

Treatment.—The preventive treatment of scarlet fever is by far the most important, and is more practicable than in any other exanthem, because the infectious principle, although most tenacious of life, is not so active as that of some other diseases. Strict quarantine is particularly efficacious, and thorough cleansing and exposure to sunlight and air day and night will usually destroy the focus of disease. Isolation, with proper precautions, is entirely effective in this disorder. A room should be chosen which can be isolated; if this is impossible, keep the child in the same one in which the infection first showed itself, and do the best practicable. The care of the room is of the first importance: every movable object should be taken out except those absolutely needed. Temporary curtains of sheets wrung out of antiseptic solutions (Labarraque's or bichlorid) may be hung in front of doors. The dresses of the attendants should be washable, and their hair protected from contamination by a close-fitting cap. The physician should never enter the sick-room without extreme precautions, and should be specially attired. The room should be exposed to the sun and kept cool and airy, provided with, if possible, an open fireplace, the temperature, at first, 68° F. at the head of the bed; later, cooler if fever is high, or warmer if complications arise. The body of the patient is the better for constant anointing with boric ointment, which should be wiped off afterward and will thus assist in cleansing as well as disinfecting, and prevent the spread of the epithelial scales during the process of desquamation, which are so highly infectious. This should be supplemented by daily spongings of the

surface in tepid water, to which it is well to add green soap. Recent observers report excellent results from rubbing the body three or four times a day with oil of eucalyptus or 5 per cent. ichthyol. (For further remarks on disinfection of the room and clothing see Diphtheria.)

In the prophylaxis of the individual it is especially important that the throat receive attention, not only of the patient, but of all others exposed to the infection. In the patient it seems probable that an ill-conditioned nasopharynx is the instrumental cause of additional infection, hence complications. This should receive almost the first and constant attention, by means of antiseptic washes and applications, astringent and other.

Scarlatina is a self-limited disease, and no remedy controls or arrests. The bowels require the first medication, and it is particularly wise, as Jacobi urges, to use, in the very beginning of the disease, moderately laxative doses of calomel, and to repeat the use of calomel on the first appearance of nephritis. The diet should be carefully limited to milk and milk preparations, light soups, and broths, although there may be permitted, as soon as the fever subsides below 102° F. (38.8° C.), moderate amounts of starchy and other foods. The general treatment of scarlet fever is an intelligent expectancy, watching the symptoms with a critical eye. The system is laboring under an intense poison, which can not be artificially eliminated. If the rash does not come out adequately on the skin, warm or hot baths to the entire surface or only the feet should be employed, or, possibly, the wet-pack or mustard bath, with the internal use of hot drinks or febrifuges, such as the solution of ammonium acetate, alone or with citrate of potassium. For high arterial tension aconite is the safest remedy, repeated in drop doses every quarter or half-hour, and then at lengthening intervals, along with the saline diuretics mentioned previously. If cerebral symptoms appear, it is well to give several doses of calomel and a mixture of bromid of sodium with chloral hydrate, or even Dover's powder or other opiate, especially codein. If this is during hyperpyrexia, coal-tar antipyretics and brandy work happily, provided cold applications are insufficient. Disturbances of the digestion are not particularly common: vomiting is occasionally troublesome at first, for which bismuth preparations along with small doses of calomel are useful, given dry on the tongue, or, for younger children, bismuth in solution, along with the aromatic waters, as the equal parts of chloroform-, cinnamon-, and lime-water. Diarrhea may be controlled by very much the same measures, to which may be added a little paregoric, Dover's

powder, or carbolic acid in minute doses. The cervical adenitis, so distressing in appearance, is to be best controlled by local cleansing of the nose and nasopharynx, and by applications of cold or lead-water and laudanum, rather than by the time-honored officious medication, by iodin, mustard, etc., externally applied.

Rheumatism, or that arthritis which very closely resembles it, is a frequent and early complication, appearing often within the first week, and is controllable by the salicylates, combined, if very painful, with small doses of acetanilid, phenacetin, or the other coal-tar analgesics. The affected joints should be wrapped in cotton-wool, with moist applications of some alkali or methyl salicylate. This may be complicated by endocarditis or pericarditis, which demands extra precaution and appropriate treatment. (See Endocarditis.) The lungs are not so frequently affected as in measles; nevertheless they occasionally suffer. The heart, as in all infectious processes, demands the most solicitous watching. The most serious complication of scarlet fever is nephritis. This varies according to different epidemics, and also with the amount of care the patient gets from the first. Probably the worst cases arise from mild attacks of the fever, which frequently escape detection, and hence for which insufficient precautions are used. Rest in bed is absolutely essential to safety, as only thus can a uniform temperature be maintained over the entire skin surface. The urine should be examined almost daily from the first, and also long after the child has been allowed to get up and be about. Should albumin appear, the urine become scanty, or the limbs dropsical, every effort should be directed to encouraging the action of the skin and intestines, which must then assume part of the functions of the damaged kidney. Water is the great diuretic, especially a bland water free from salines, and the child must be induced by various devices to consume as much of this as possible. All sorts of innocent things may be added to water for this purpose, making it as attractive as possible. The skin must be excited by baths, warm and gradually heated from 95° F. (35° C.) up to 100° or 105° F. (37.7° to 40.5° C.); or by the wet-pack, and, again changing these, if depression sets in, to hot-air baths and foot-baths. Ichthyol, 5 per cent. in lanolin, is extolled as an antiseptic application. Of medicines, pilocarpin stands at the head, from $\frac{1}{50}$ to $\frac{1}{25}$ of a grain, also the acetate and citrate of potassium, made agreeable by lemon-juice or other aromatics. Cathartics are often required, such as calomel or the compound jalap powder, but may become dangerous, depleting the blood and weakening the heart. Locally, poul-

tices do service. Dry cupping has its merits, too; also stimulating liniments and local wet-packs. Later, if anemia is apparent, a well-matured tincture of the chlorid of iron is an efficient remedy, alone or added to dilute phosphoric acid or in the form of Basham's mixture. If blood appears in the urine, astringents are required: ergot and gallic acid and nitroglycerin, $\frac{1}{800}$ to $\frac{1}{200}$ of a grain in alcoholic solution.

Cerebral complications, restlessness, continued convulsions, insomnia, and delirium are in a great measure the result of the intensity of the febrile movement, and in a sense are the criteria of the severity of the disease. These are best controlled by the water applications,—baths, packs, etc.,—and if continued, by cold to the head—a good way is to hold the child's head over the side of the bed and pour cold water on it. Convulsions may be evidences of uremia.

Malignant cases demand powerful stimulation with ammonia, whisky, caffein, and musk, along with strychnin. Alcohol may act as a useful tranquilizing agent.

The throat is constantly an object of solicitude. In almost all cases is seen the characteristic macular eruption on the pillars of the pharynx, posterior walls, and uvula. Here antiseptic and astringent solutions are of value to relieve symptoms.

M. Roger, Huber, and Blumenthal have recently reported good results from the injection of serum from convalescents. Gordon reports good results from antistreptococcic serum; Rappapart regards it as useless.

VARIOLA.

Synonym.—SMALLPOX.

Variola is an acute infectious disease, characterized by a sudden onset, severe frontal headaches, lumbar pains, and abrupt fever, which falls to normal or nearly so upon the appearance of an eruption, which passes through the stages of papule, vesicle, pustule, and crust. It is now seldom seen in civilized countries, being entirely under the control of vaccination.

Causes.—Smallpox is one of the most virulent of the contagious diseases, and it is in all probability due to a microorganism, although the specific cause or germ has not, as yet, been isolated. The contagium is contained in the secretions and excretions, the exhaled air, and the pustules, and may remain dormant for a long time in clothing or other objects.

Unless protected by vaccination or a previous attack of smallpox, most people are susceptible. All ages are attacked, from the

very old to the fetus in utero. Sex has no influence. It is claimed by some that the colored race is more susceptible than the white.

Symptoms.—Smallpox is usually divided, according to the severity of the process, into three classes, as follows: (1) Variola vera (discrete and confluent), true smallpox; (2) variola hæmorrhagica, or black smallpox; (3) varioloid or modified smallpox.

The incubation period of smallpox ranges from ten to eighteen days, but by far the most usual time is fourteen days.

The stage of invasion usually begins in children with a convulsion, followed by a sudden rise in temperature, frontal headache, and distressing lumbar pains. Vomiting is often an annoying symptom. The fever rises rapidly, and reaches its height at about the end of forty-eight hours, and ranges from 103° to 105° F. (39.4° to 40.5° C.). With the high fever there are often associated marked delirium and restlessness.

The pulse is rapid and full, but not dicrotic. Vomiting or anorexia is the rule; also constipation at the beginning.

During this stage the preeruptive rashes are seen. They are either fine, resembling scarlatina, or macular, resembling measles. Petechiæ are also noticed, as well as urticaria. These rashes occur in from 10 to 16 per cent. of all cases.

Eruption.—(*1*) *The Discrete Form.*—The eruption begins to appear at the end of the third or the beginning of the fourth day, and is first noticed at the edges of the hair and upon the wrists as hard, shot-like papules beneath the skin. With the appearance of the eruption the fever falls to normal and there is a subsidence of all distressing symptoms. The eruption, after beginning on the face, appears on the rest of the body, and last upon the lower extremities. It is always thickest upon the face and extremities. Frequently, when the eruption is confluent upon the face, the lesions may easily be counted upon the body. On the fifth or sixth day the papules begin to change into vesicles, with a slight depression or umbilication at the center. On the eighth or ninth day the vesicles change into pustules. They then lose their depression or umbilication, and become oval or globular in shape and grayish yellow in color, instead of the clear serum of the vesicles. With the formation of the pustules the fever rises,—the secondary fever,—and the skin around the pustules becomes red and inflamed. The face and eyes are swollen, and are frequently painful. There is ofttimes a return of the delirium with the fever, sometimes more marked than at first. In discrete smallpox the fever usually begins to fall by lysis at the end of thirty-six hours, the pustules break and begin to form

crusts, and the swelling subsides, so that on the twelfth or thirteenth day convalescence may be well established. In a few days more the scabs begin to fall away.

The confluent form usually begins with the same symptoms as the discrete form, except that they may all be intensified. The eruption appears about the fourth day, either running together or the pustules may coalesce later. The fever falls to near normal with the appearance of the eruption, and the patient feels quite comfortable. About the eighth day the pustules are fully formed or matured, and the fever again rises to 103° to 105° F. (39.4° to 40.5° C.). With the rise of the fever the delirium often appears. Children are apt to suffer from diarrhea, and complain of great thirst. The pocks may be seen in the mouth, pharynx, and air-passages. This often gives rise to a fetid discharge, and when in the larynx, to huskiness of the voice and sometimes edema of the glottis. At this stage hemorrhage may take place into the pustules, and exhibit a bluish center—a very unfavorable symptom, and is sometimes described as a variety of the hemorrhagic form, or variola hæmorrhagica pustulosa. The face is swollen, the eyes are closed, and the lymph-glands are markedly enlarged. The skin is painful and tender, and the itching is frequently annoying. During this stage delirium, subsultus, and diarrhea are symptoms of bad omen. When recovery takes place, the pustules break about the twelfth or thirteenth day, and crusts begin to form. The fever subsides about the third week; in severer cases about the fourth week. Convalescence is slow and prolonged, as a rule, and patients are frequently tormented with numerous boils.

VARIOLA HÆMORRHAGICA.—Hemorrhagic or black smallpox presents nearly the same symptoms during the initial stage as variola vera, but they are all more marked and severer. Frequently on the second day a hyperemic condition of the skin appears, ecchymotic spots show on the conjunctiva, and bleeding frequently occurs from the mucous surfaces. Death usually results before the variolous eruption appears. However, the shot-like papules may be felt at the edges of the hair and upon the wrists.

VARIOLOID.—The initial symptoms of smallpox modified by vaccination may be intense, but with the appearance of the eruption they all subside and the patient is practically well. The eruption consists of a few papules scattered over the body. It runs a shorter and milder course, and the crusts separate much sooner than in the unmodified variety. Some of the papules never develop pustules, and, as a rule, there is no secondary

fever. This variety, however, is sometimes very difficult to diagnose.

COMPLICATIONS.—*Digestive System.*—Vomiting or anorexia is frequently met with early. Swallowing is sometimes difficult, owing to the swelling of the glands and the lesions located in the throat and mouth. Diarrhea is frequently a serious complication. Sometimes lesions in the rectum give rise to symptoms of dysentery.

Circulation.—The pulse is full and rapid, not dicrotic. Myocarditis occurs occasionally, but endocarditis and pericarditis are very rare.

Respiratory Tract.—The mucous surface of the upper respiratory tract is frequently the seat of the lesions, and they give rise to fetid discharges. Pocks in the larynx may extend through the mucous membrane and cause destruction of the cartilage or give rise to fatal edema. Bronchitis and bronchopneumonia are frequent complications. Lobar pneumonia is unusual.

The kidneys may show a febrile albuminuria, but true nephritis is rare. In hemorrhagic cases hematuria is sometimes present.

Skin.—Numerous boils sometimes follow and prolong convalescence.

Eye.—Conjunctivitis is frequently noticed, and unless the eye is kept clean and aseptic, keratitis and iritis may follow, with loss of sight.

Pathology.—The *papule* consists of a cellular infiltration of the rete mucosum, which soon undergoes coagulation necrosis. At the apex of a papule a vesicle is formed, due to the circumscribed inflammation and exudation of serum beneath the epidermis. The vesicles contain serum, leukocytes, and fibrin filaments, and are loculated. There is also a depression in the center, the so-called umbilication. The *pustules* are formed by a filling of the reticuli with leukocytes. When the pustule is confined to the rete mucosum, there is no pitting or scarring; when it extends through the true skin, pitting invariably follows. True "pocks" are found on the skin and also on the buccal mucous membrane, esophagus, and larynx, but rarely in the stomach, rectum, or bronchi. In hemorrhagic smallpox there is an early extravasation of blood beneath the skin, into the mucous and serous membranes, the parenchyma of the different organs, the connective tissue, and nerve sheaths. There are no true pocks found in the lungs, but bronchitis and bronchopneumonia are frequently associated with the disease, and also lobar pneumonia and pleurisy occasionally. The heart is sometimes the seat of myocardial changes, but rarely of endocarditis or pericarditis.

Small areas of fatty degeneration are found in the liver. The spleen is enlarged. The kidneys may show a cloudy swelling, seldom a true nephritis.

Prognosis.—Prognosis depends on the type or variety which the physician meets. In the discrete form the prognosis is very favorable. In the confluent form it is grave, and in the hemorrhagic form is almost always fatal. Varioloid is in most cases followed by recovery. In children, however, it is usually unmodified. Out of the 5000 cases reported by Wm. M. Welch, physician-in-charge of the Municipal Hospital of Philadelphia, Pa., there were 80 cases under one year of age. Of these 80 only 2 had been vaccinated, leaving 78 unvaccinated. The mortality among the unvaccinated 78 was 57, or 73.07 per cent. These figures show the high mortality among unvaccinated children under one year of age, and that smallpox almost always occurs in the unvaccinated. From one to seven years of age: 404 unvaccinated cases were admitted and 208 died, or 51.48 per cent.; of the 35 vaccinated cases 2 died, or 5.7 per cent. Up to seven years of age the death-rate is about 60 per cent. among the unvaccinated.

Diagnosis.—In typical cases of smallpox the characteristic initial stage, with the headaches, lumbar pains, vomiting, and high fever, together with the appearance of the eruption on the fourth day, which is at first papular, then vesicular, then pustular, makes the diagnosis comparatively easy. In some atypical cases it is liable to be confounded with varicella or chicken-pox. The chief points of difference are as follows:

VARIOLA.	VARICELLA.
Initial stage marked.	Initial stage absent or very mild.
Eruption appears at the end of third or beginning of fourth day, and is first papular, then vesicular and umbilicated, then pustular.	Eruption appears on the first day as a vesicle and is not umbilicated.
Vesicle is multilocular; the skin or covering is very tough and not easily broken with finger-nail.	Vesicle is unicellular, and the covering is very thin and is easily broken with finger-nail.
Vesicle does not collapse when pricked with a pin.	Vesicle does collapse when pricked.
Eruption thickest on face and extremities.	Eruption thickest on trunk, especially the back.
Various stages of vesicle at points removed from each other.	Various stages of vesicle side by side: some are just appearing, while others are beginning to form crusts.
Runs course in from five to six days in mild cases, and in ten to fourteen days in severe cases.	Runs course in from two to five days.
Secondary fever, as a rule.	No secondary fever.

Scarlatina and measles should not give rise to any difficulty, and for diagnostic purposes the reader is referred to the articles on those diseases. The eruption of impetigo contagiosa may resemble variola, but the absence of the initial stage and fever and the superficial character of the lesion should make the diagnosis plain.

Treatment.—The prophylactic treatment is vaccination, which is capable of causing the ultimate disappearance of the disease. When smallpox occurs in private families, it is earnestly advocated that all patients be sent to a hospital, on account of the extreme difficulty in securing suitable isolation and protection for the public. The general arrangement of the room and thoroughness in disinfecting all articles of clothing, etc., about the patient should be observed, as is advised in the care of diphtheria patients. (See article on disinfection under Diphtheria.)

During the initial stage opium is needed for the pains in the limbs and back. For the relief of the vomiting such remedies as bismuth, pepsin, cerium oxalate, cocain, iced champagne, and bits of cracked ice may be used. The fever should be controlled by the cold bath or cold-water sponging. In administering the cold bath it is advisable to begin with tepid water of 90° or 95° F., and gradually reduce the temperature to 75° or 80° F. For the eruption it is advisable to keep patients in a dark room, and the application of such lotions as a saturated solution of boric acid on lint or weak solutions of bichlorid or carbolic acid. Emollients, such as cold cream or vaselin, frequently relieve the itching and keep the crusts soft. The eyes should be kept clean with boric acid solutions; also the nares and mouth. Diarrhea is frequently a troublesome symptom, and is best controlled by bismuth and, possibly, a little opium. The diet should be carefully adjusted to the needs of febrile states. For the extreme weakness whisky should be given. Quinin also is indicated, especially during the stage of pustulation, and when the secondary fever is high.

VACCINIA.

Synonym.—Cowpox.

Vaccinia is an eruptive disease occurring among cattle, which, when inoculated into the human system, produces mild constitutional symptoms and a local manifestation resembling the pock of variola, and confers more or less permanent immunity against smallpox.

History.—While yet a medical student, Jenner's attention was

called to the fact that milkmaids in Gloucestershire, England, who became accidentally inoculated with cowpox were immune to smallpox. After thoroughly investigating the matter and by numerous experiments he was convinced that cowpox artificially produced in the human system rendered it immune to smallpox. He published his discovery to the world in 1798. Since then vaccination has come to be universally practised in all civilized countries, and, as a consequence, smallpox is at the present day robbed of its terrors.

Varieties of Virus.—Formerly, humanized virus was altogether used, but since the introduction of bovine virus it has almost entirely taken its place. Bovine virus is absolutely incapable of conveying syphilis, which occasionally follows the use of humanized lymph. Whenever humanized lymph is used, great care should be taken in selecting a child who is entirely free from any syphilitic or other infectious taint. The humanized lymph acts more promptly and is not followed by such severe constitutional manifestations as the bovine lymph. When it is desired to get a quick result,—as, for instance, in a person who has been exposed to smallpox,—it is advisable to use humanized lymph; otherwise bovine is to be preferred.

The site for the inoculation usually selected is the arm, but in females it is frequently desirable to use the leg, for esthetic reasons.

Technic.—The site should be rendered aseptic by scrubbing with soap and water and then rinsing with sterile water. If any antiseptic were employed, it might render the vaccine virus inert. After the site has been cleansed, it should be dried with a clean cloth, and then gently scratched or scarified with a sterile needle or lancet until the site is bathed with serum. Avoid drawing blood, if possible. The technic is the same for both humanized and bovine lymph up to the point of applying the virus.

1. *Glycerinized Lymph.*—Break off each end of the capillary tube, and on one end place the small rubber bulb that is always supplied, and hold the other over the spot that has been scarified, then press the bulb and force out the virus, rub it in thoroughly, and dry in the air.

2. *Ivory Points.*—Dip the ivory point into tepid sterile water and thoroughly rub it over the place to be scarified for vaccination. Instead of using the needle or lancet to scarify, it may be done with the ivory point. After vaccination the serum should be permitted to dry in the air.

3. *Arm-to-Arm.*—A well-developed vaccine vesicle is selected at about from the fifth to seventh day before the areola is

formed. Some of the serum is transferred from this and well rubbed in the same way as above.

4. Crust or Scab.—A vaccine crust or scab taken from a healthy child is selected. A small piece is placed between two pieces of glass and thoroughly powdered. To this some sterile water is added, enough to make it of the consistence of cream. Then proceed as above.

Certain physicians prefer some kind of dressing for the wound, but it has always seemed to us that the best results were obtained by simply permitting the site to dry in the air.

Period of Life.—First vaccination should be done in a strong and healthy child at about the third month. If the child is not strong, it may be advisable to wait unless smallpox is prevalent. The second vaccination should be done when the child has completed its first dentition; the third about the time of puberty.

VARICELLA.

Synonym.—CHICKEN-POX.

Varicella, or chicken-pox, is a mild, infectious disease of childhood, the chief characteristic of which is a papular rash rapidly changing into vesicles with pearly contents, and always appearing in successive crops, with slight constitutional disturbance. Though quite a distinct entity, it bears a close resemblance in many of its symptoms to a modified form of smallpox. Varicella is distinctly a disease of childhood, few adults and those only who have been nursing or thrown into intimate and prolonged contact with the patient being attacked by it. Its right to a distinct place in the list of infectious diseases, in contradistinction to its being merely a modification of variola (as is sometimes stated), lies in the fact that varicella and variola do not mutually afford immunity, that variola affects all ages, and that direct inoculation with the virus of variola always produces that disease, and, likewise, varicella inoculation invariably (when the operation is successful at all) produces varicella. The disease occurs in epidemics and is especially common in the poorer districts.

Causes.—Chicken-pox is due, in all probability, to its own specific germ. It is contagious, and the infective principle retains its vitality for a considerable period in clothing, bedding, etc. It may be communicated from child to child by direct contact, and a third person can also be the medium of communication. The period of incubation is variously estimated, a fortnight being the average time.

Symptoms.—Before the outbreak of the eruption there is generally experienced a feeling of slight indisposition, some headache, but no definite premonitory symptoms. Usually the first notice of the disease is the appearance of the eruption itself. At or before the period of the eruption there are loss of appetite, weariness, and, as the macules appear, fever, the temperature rising to 101° or 102° F. (38.3° to 38.8° C.). There may also be chilliness, and in very severe cases even convulsions, although they are very rare. The eruption appears simultaneously in different parts of the body, beginning, as a rule, in the borders of the face, behind the ears, and in the edges of the hair, and consists in successive crops of rosy papules, not unlike typhoid fever, and small bullæ or blebs, which are of the simple unilocular variety, not umbilicated as in variola, or very rarely so. The base of the vesicle is inflamed, and there is a slight aureole of flushed skin around the papule. The vesicles contain a limpid, pearly fluid which remains fairly clear unless irritated, as by scratching, when it is liable to become purulent or ulcerative. Usually the vesicles dry up in a few hours and a scab forms, which ultimately falls off, leaving a clear unscarred skin underneath. This is the normal termination of the varicella eruption, though it not infrequently happens that a scar similar to the scar of smallpox is left behind. The successive crops of vesicular papules last about a week, although the disease itself is over in half that time. If pricked, the vesicles collapse. The number of these vesicles over the body varies greatly, sometimes being few in number and at other times quickly dispersed over the entire body; the face, however, having a much smaller number in proportion to other parts.

Diagnosis.—As already stated, modified smallpox may be mistaken for varicella. The principal points of differential diagnosis are as follows:

VARICELLA.	MODIFIED SMALLPOX OR VARIOLOID.
1. Incubation about fourteen days.	1. Incubation twelve days.
2. Premonitory symptoms slight.	2. Severe, with high temperature, intense backache, vomiting; all the symptoms of a severe disease.
3. Premonitory fever lasts but a few hours.	3. Lasts two or three days.
4. Temperature-rise slight.	4. Temperature rises suddenly and reaches its height when papule is fully developed, after which temperature falls. No secondary fever.
5. Rosy spots, macules becoming vesicular in a few hours and drying in three or four days, leaving crusts. Eruption comes out in crops and spots and is not confluent. No pustules.	5. Red, shot-like papules appearing on face, anus, and mucous membranes. In one or two days the papules change to vesicles, and on the eighth day develop into pustules.

VARICELLA.	VARIOLA.
1. Appears chiefly in children.	1. Attacks persons of any age.
2. Duration of disease short, and symptoms very mild.	2. Period of invasion three days; general symptoms severe.
3. Eruption papular or vesicular: never pustular.	3. The papular stage is longer, and the eruption ends with formation of pustules.
4. The eruption is superficial, rarely umbilicated, not partitioned, multilocular, and discrete.	4. Eruption is deep-seated and hard, usually umbilicated, the vesicles being partitioned and frequently confluent.
5. Eruption appears chiefly on hands and feet, very little on face.	5. Eruption chiefly on face, hands, and feet.
6. Not influenced by vaccination or previous attack of smallpox.	6. Prevented by vaccination or previous attack of smallpox.

Delicate children should be isolated. Those attacked should be carefully guarded.

The **prognosis** is invariably favorable. In unhealthy children, especially those affected with scrofula or tuberculosis, the vesicles often degenerate into ulcers, and these may spread and take on a serious aspect.

Treatment.—Chicken-pox calls for very little treatment, but it is of more importance to insist upon rest and freedom from exposure than is ordinarily taught or practised. While it is perfectly true that children suffering from this minor exanthem are usually permitted to run about and disport themselves much as they like, upon the assumption of the parent or physician that the dangers of complication are small, yet it is certainly true that complications do arise, sometimes seriously affecting organic integrity. A child suffering from chicken-pox should be isolated at least for a week, and kept under uniform and controllable conditions of air and temperature, thoroughly protected from chill, exposure, or undue fatigue, supplied with a simple dietary and a diuretic and diaphoretic, and go early to bed. During convalescence definite control should still be exercised over fatiguing conditions, exposure to extremes of heat or cold, and some attention given to the digestive organs and dietetics. Some poverty of the blood is liable to result from even so slight a febrile process as this, and a tonic, with change of air, should be supplied when convenient or obviously needed.

MALARIAL FEVER.

Malarial fever, intermittent fever, fever and ague, chills and fever, and a number of other names are applied to a variety of febrile, specific, and noncontagious diseases caused by the presence in the blood of a protozoon known as the hematozoon of

Laveran, also called by Marchiafava and Celli the plasmodium malariæ, and characterized by extreme anemia, enlargement of the spleen, and by fever with periodic intermissions or remissions.

Causes.—Malarial fever is very widely distributed and more or less constantly present throughout the known world. In America it is constantly endemic in certain regions, as in the Southern States and here and there in the Central States, especially in lowlands near the coast, along the edges of salt or partly salt estuaries, and less so on the Great Lakes. Its habitat also changes, appearing and disappearing under conditions recognizable or not. Again, the intensity of the attack varies considerably in different years, as does also the type of the disease. Swamp or marsh fever, as the disease is also called, receives this particular name because of its prevalence in low, moist, ill-drained districts, and it seems to bear some relationship to man's occupation or interference with the natural conditions of the locality, such as the forming of artificial dams and otherwise interfering with the course of natural waterways. The contagium seems to be propagated through the air as well as in other ways not clearly demonstrated. At the present time two modes of transmission are worthy of consideration—by aërial transfer and by suctorial insects, chiefly mosquitos. Laveran says it is also possibly acquired through drinking-water. Outbreaks of chills and fever occur at special seasons, usually the late summer and autumn, although occasionally in the spring and early summer. Prevailing as it does in tropical climates constantly, the chief increments are in the spring and fall. Laveran originally made known to us the specific micro-organism which is now recognized as the exciting agent of malarial fever, and his researches have abundantly been confirmed by careful observers in this country and in Italy, also in Germany, South America, and India.

In this country and in Italy there are several distinct types of malarial fever: First, mild forms of more or less pronounced characteristics, divisible into tertian and double tertian fever and quartan fever and its combinations; and severe forms, more or less irrregular, occurring chiefly in the later summer and autumn, including remittent malarial fevers, cases of malarial cachexiæ, and certain pernicious forms. In Italy these are exhibited in several forms, but here we see usually the tertian and quotidian type, and a special variety of micro-organism has been found to accompany each. The morphologic characteristics of the malarial parasite show it to belong to the class of protozoa containing a nucleus or one or more nuclei.

Types and Variations of Malarial Fevers.—*1. Tertian Type of Single Infection.*—This is the simplest form of malarial infection. A single group of organisms propagate themselves in the blood and reach the stage of segmentation at about the same time. It has been stated that the tertian type of organisms complete their cycle in forty-eight hours.

2. The Quotidian Type.—If we have what appears to be a full growth of the organisms each day, as judged by daily paroxysms, the quotidian type is exhibited. Examination of the blood from such a case shows two separate sets of organisms of the same class, but in different stages of development, the first maturing one day and the second maturing the next day following, and each producing a chill at the time of segmentation. This, of course, depends on a double infection occurring at different times. On the other hand, the group of the second infection may have been smaller than the first, so that we may for a period have only the tertian type until such time as the second group may grow to be of sufficient importance to produce a paroxysm. The second group may always remain smaller, and accordingly its paroxysm will be less severe, and it may also mature at a different hour. So we have the clinical picture of a case with tertian paroxysms in a few days becoming quotidian, the second paroxysm being lighter and at a different hour.

3. Quartan Type.—This depends upon the presence of malarial organisms growing to segmentation in seventy-two hours, and examination of the blood will show, if there is a single infection, one group of organisms. Every fourth day (two full days intervening) we have a paroxysm of from eight to twelve hours' duration, which shows very little tendency to anticipate or retard. Quartan infection may be double as well as single, so that we see an attack coming on two successive days with one intervening day subject to the same variations as seen in the quotidian, but examination in this condition will show two sets of organisms at different stages of development. Again, there may be a triple infection, so that the period of segmentation comes daily, and we now have a quotidian type, the nature of which only a blood examination will settle.

Paroxysms are essentially the same in both classes of infections, whether it is single, double, or triple, differing only as to severity, which depends upon the strength of the individual groups.

The estivo-autumnal variety differs from the foregoing types in its proneness to become pernicious, and depends for its origin on infection of the estivo-autumnal parasite. It presents itself

as a quotidian, intermittent, and malignant tertian. It is quite irregular in its course, due first to the fact that the development of the different groups is not completed at the same time; segmentation is spread over a longer period of time (twenty-four to thirty-six hours), and there is a tendency to anticipate segmentation; and, secondly, to the factor of mixed infections. Should a quotidian intermittent fever present itself, we may be able to determine which type of disease we are dealing with only by a blood examination, and since the segmentation is irregular, we may clinically have at no time a complete intermission, but a remission and a chill again preceding the rise of fever.

There is also a malignant tertian, in which the temperature-curve makes a sudden ascent, remaining high for a number of hours, fluctuating but little, dropping part way only to rise again, and finally dropping to normal, the entire paroxysm often lasting thirty-six hours. There is a strong tendency to anticipation, so that the temperature may be continuous, presenting many of the severe constitutional symptoms which go to make up the clinical picture of typhoid fever.

Pathology.—It is a very important and practical item of equipment for the physician to be familiar with the methods of clinically examining the blood in suspected malarial infection. The parasites found in the blood of patients suffering from malarial fevers belong to the protozoa. Different types of the disease present parasites with different characteristics. When the blood-corpuscles and the protozoa which they contain are studied, one skilled in blood examination can differentiate the form of the disease, the frequency of the paroxysms, and also foretell, from his knowledge of the life of the protozoa, the hour of the coming of the next paroxysm, provided, of course, he knows the hour of the last one.

The blood should be examined in the first stage in dried unstained films and in dried stained films, each possibly having certain advantages. However, we would recommend the use of both fresh blood and of dried, stained blood. In the fresh films we should use a small drop and avoid pressure. Such films may further be preserved by excluding the air by putting vaselin or wax around the edges of the cover-glass. The chief advantage of this method is that it gives an opportunity to study the ameboid movements of the protozoa, and the disadvantage is that one must examine it very soon after withdrawal—at the most within three to four hours. The stained films give an opportunity for more careful study of the elements which are exhibited distinctly by the stain. Double staining with eosin and methyl-

blue or eosin and hematoxylin, preferably the latter, is the most satisfactory. The method is the same as for ordinary blood examination. The blood should preferably be selected just before (an hour or so) the expected paroxysm, though it may be taken at any time. If it should be observed just after a paroxysm, the organisms are small.

The tertian parasite completes its life in about forty-eight hours, or less if there is any variation from this time. In the first twelve hours of its life the parasites appear as small, clear specks (hyaline bodies) in the red corpuscles, and if any pigment is to be seen, it is as very small granules. If stained, they appear pale blue. They are actively ameboid, and remain so for about an hour after withdrawal. In the next twelve hours the parasites have grown to about one-third the size of the corpuscle, are still ameboid, show fine granules, and the corpuscle has become paler. In the next twelve hours the parasites have taken up about two-thirds of the cell, have become less ameboid, the granules larger and moving. The parasites are now more irregular in shape, and the corpuscles larger and paler, the pigment granules standing out more markedly. In the next twelve hours all motion ceases, the corpuscles become shells, the centers of which are occupied by the parasites, and spore formation and segmentation begin. The organisms break up into fifteen or twenty round spores, at first contained inside the cell-wall of the red corpuscles, and then set free into the blood. It is at this time that the clinical paroxysm occurs. All hyaline bodies do not develop to the stage of spore formation, nor do all these spores—really the young hyaline bodies—which have been set free into the blood-serum reenter the red corpuscles, but the blood plasma in itself destroys many of them.

Should we have under observation clinically a quotidian form of malaria, the red corpuscles would show the tertian parasite but in two stages of development, one group being approximately twenty-four hours older than the other, of course depending upon the hour at which the paroxysms occur. This is due to a double infection. It must not be forgotten, however, that we may have a triple quartan infection that produces daily paroxysms.

The quartan parasite grows in seventy-two hours. In the first twelve hours it is a very small, unpigmented, slightly ameboid, hyaline body, becoming in twelve hours more about the size of one-sixth to one-fifth that of the corpuscle, having taken on a few pigmented granules placed peripherally. In forty-eight hours it is one-half to two-thirds the size of the red

corpuscle, round, as a rule, and possessing no ameboid movement. In sixty hours from the paroxysm it occupies nearly all of the corpuscle, which is neither enlarged nor paler than normal. In six hours more the pigment granules approach the center and are arranged like the spokes of a wheel, the first sign of segmentation. About three hours before the attack segmentation has produced from six to ten oval or pear-shaped bodies or spores containing pigment in their centers.

In multiple infections of this type we, of course, find the organisms in the blood in different stages of development.

Flagellated bodies develop after the blood is removed from the body, and consist of a central cell with arms thrown out. These arms are freely movable. In examining a fresh specimen, we may see such a body keeping up a constant ciliary motion and causing a disturbance in the arrangement of the red cells in its immediate neighborhood. The flagellated body does not often appear in either of the foregoing types of the infection, but is more common in the estivo-autumnal variety.

The second group of parasites belongs to the class of malignant or estivo-autumnal figures, and are divided into, first, the pigmented quotidian parasite ; second, the unpigmented quotidian parasite ; and third, the malignant tertian.

The pigmented quotidian parasite completes its cycle in twenty-four hours. When seen in the blood-corpuscle, it appears as a small, actively ameboid, hyaline body, rapidly becoming pigmented and quiet, the pigment lodging in the periphery of the organism, after which it breaks up into spores. It has been pointed out that segmentation of this type does not take place in the peripheral blood, but occurs in the spleen and bone-marrow. The pigmented organism occupies one-third of the corpuscle, which is shrunken, if changed at all. After the infection has lasted for several days crescents appear.

Crescents are always an evidence of estivo-autumnal fever, and never occur in the quartan or tertian type. They are from eight to ten micromillimeters in length and from two to three micromillimeters in breadth, are half-moon shaped when typical, but vary greatly, oftentimes appearing almost straight. They contain pigment, sometimes scattered, but oftener found clumped in the center, and usually without motion. With a good light and an accurate adjustment the shell of the red blood-corpuscle can be seen extending from the poles of the crescent, showing that this parasite is distinctly an intracellular formation. Crescents are distinctly an evidence that the infection has lasted a

number of days,—five or six,—and they will not be found in any specimen before that time.

The unpigmented quotidian parasite shows not many variations from the foregoing type, except that it is free from the pigment, though the crescents formed from this variety may show pigmentation.

The malignant tertian parasite is pigmented and, in fact, much like the pigmented quotidian. It grows to segmentation once in forty-eight hours, and is ameboid in the advanced stage; the pigment is active and the entire organism is larger. Probably no better idea can be given concisely of the different characteristics of these parasites than by reproducing the table of Mannaberg's. (See p. 696.)

Pathologic Anatomy.—In subjects dead of acute malarial fever there are found few characteristic changes except those of the blood, as described at some length; the brain shows little hemorrhage, perhaps a few punctate hemorrhages, with slight subpial edema.

In the milder forms of malarial fever there are very slight characteristic changes. In the chronic forms there is a malarial cachexia, of which anemia is the chief feature, with enlargement of the spleen, thickened and adherent capsule, and dark color, showing fibrous thickening throughout. The liver is generally enlarged, and gray or slate-colored rather than brown. In death from pernicious malaria the brain may show some edema under the pia, with evidences of hyperemia and occasionally punctate hemorrhages, possibly due to granular or fatty degeneration of the endothelium of the vessels. The malarial parasites may be found in profusion in the cerebral capillaries. The spleen in these cases is always large, the parenchyma cyanotic, and it may actually suffer rupture. The liver is of slate-gray color usually. In both these organs the capillaries are filled with leukocytes, and many malarial parasites can be found. The kidneys show relatively few plasmodia.

Symptoms.—The milder forms of intermittent fever—those which are commonly seen in the temperate zone and warmer countries, especially in the spring and early summer—are the tertian and quartan fevers, each with certain variations. Tertian intermittent is the form usually seen in this country. The quartan is very rare, and may be differentiated by blood examinations. The outbreak of fever and ague is due to the invasion of the blood by a specific organism, which passes through its cycle of existence in forty-eight hours. The febrile paroxysm occurs when the protozoa reach their height and begin to segment, the

		Duration of the Disease.	Movements.	Pigmentation.	Maximum Size.	Form of Spore Formation.	Number of Spores	Crescent Bodies.	Alterations in the Infested Blood-corpuscles.
Simple Intermittent Fever.	Quartan parasite.	Seventy-two hours.	Small movements in immature forms.	Coarse granules, little or no movement.	Size of red blood-corpuscle.	Daisy form, single spores, round, with distinct nucleolus.	6 to 12.	None.	Red blood-corpuscles are little discolored and do not alter their size.
	Ordinary tertian parasite.	Forty-eight hours or less in anticipating cases.	Active ameboid movements in immature and also in middle-aged forms.	Fine granules in immature forms, often in the larger, actively swarming.	Size of red blood-corpuscle; sometimes larger.	Sunflower or grape-like, single spores, small round nucleolus, rarely seen.	15 to 20; often less.	None.	Red corpuscles are often hypertrophied, and lose their color quickly and completely.
Malignant or Estivo-autumnal Fever.	Pigmented quotidian parasite.	Twenty-four hours.	The unpigmented, immature forms actively ameboid, less active when the pigment accumulates.	Very fine, later coalesced in one or two lumps. Does not swarm.	One-fourth to one-third the size of red blood-corpuscle.	Irregularly formed heaps.	6 to 8; often more.	Present.	Red blood-corpuscles often shrink, and are thin, either take stain copper-colored or may be completely decolorized.
	Unpigmented quotidian parasite.	Twenty-four hours or less.	Very active, ameboid movement.	None.	One-fifth to one-fourth the size of red blood-corpuscle.	Star-shaped or in irregular heaps.	6 to 8.	Present.	Red corpuscles shrink frequently and are darker stained.
	Malignant tertian parasite.	Forty-eight hours.	Active movement remains present in pigmented bodies.	Moderately fine; often shows the oscillatory movement.	One-half to two-thirds the size of red blood-corpuscle.	Irregular heaps.	12 to 12; rarely, 15 or 16.	Present.	Red blood-corpuscles shrink frequently, and are darkly stained or may be perfectly colorless.

process repeating itself with much regularity at intervals of forty-eight hours. In very young children the stage of chill is replaced by mere restlessness, cyanosis, and cold extremities, with yawning, nausea, or possibly diarrhea, and along with these various motor nervous phenomena—twitching or convulsions. In the second or hot stage the fever may rise very high—to 108° F. (42.1° C.); the child is restless, thirsty, and the face is flushed, the skin is hot, the eyes are injected, the pulse is full and rapid, severe pain is felt in the head, back, and limbs, and the urine is scanty and of dark color. This febrile condition remains for an hour or two, gradually falling, and a profuse sweat follows. In this stage the fever and pain gradually subside, and the patient falls asleep, from which he awakens feeling well. In older children, beyond six or seven years, the paroxysm is very similar to that in adults, chills, fever, and sweating being well marked. Fever may reach 108° F. (42.1° C.), lasting from a few minutes to an hour. During the stage of the fever there are great thirst, dryness of the skin, fretfulness, headache, and, possibly, also a repetition of the digestive disturbances. Finally comes the stage of sweating, immediately following which there is evidence of exhaustion, but soon after prompt return to ordinary health. As in most other acute febrile processes, instead of the chill occurring as in adults, the child suffers a convulsion. Sometimes the first symptom (so well remembered by one of the authors during a long attack of intermittent fever) is scarcely recognized chilliness; if accompanied by blueness of the nails, it means the onset of a paroxysm. If, as rarely happens, the case is one of pure tertian fever, the child seems absolutely well on alternate days. A marked cachexia may follow all forms of the disease, or accompany cases treated inadequately, or wherever the sufferer has become subject to repeated attacks. Here the fever may be slight or scarcely recognized, but the child exhibits a woeful appearance, with pale, sallow skin, pinched features, sunken eyes, irritable digestion, and recurrent diarrhea. Pernicious malarial fever, rare in temperate climates, exhibits the ordinary phenomena greatly intensified, especially the neurosal features—convulsions and pupillary changes, passing into coma and collapse or death, with possibly little or no rise in temperature. Bronchitis is a common complication, and acute coryza has been known to replace the sweating stage. In children it is usual to note disturbances of the alimentary canal as the most conspicuous feature of the infection. Diarrheas are probably due to secondary infection in children whose health has thus been lowered. There is little disturbance of circulation, except the vasomotor changes seen during the

paroxysm. Slight albuminuria is observed occasionally, and hematuria rarely. A number of organic complications are alluded to, and doubtless are the results of malarial infection, but not directly due to it; they are rather evidences of devitalization, blood dyscrasia, and lowered resistance.

Diagnosis.—The periodicity of the attacks, requiring careful observation to determine; evidences of enlarged spleen, which always occurs after a few attacks; and, finally, the presence of the malarial organisms in the blood, will render the diagnosis of malarial fever, even in children, most complete. Osler says that widening experience strengthens the conviction that the value of Laveran's discoveries of the hematozoa, demonstrable in the blood, is only secondary to the finding of the bacillus of tuberculosis by Koch. It is not always easy to make the diagnosis from the clinical picture. The commonest type is the double tertian or quotidian fever. The disorder most likely to be confounded with this is tubercular infection. It must be remembered, however, that the one may be superadded to the other. The greatest difficulties in diagnosis occur in the more irregular and remittent forms and in the malarial cachexia. Here there is the inevitable confusion outgrowing from the disturbed organic activities, of which malarial fever may have been the cause. Certainty can only be reached by blood examination or a practical conviction by the less scientific but easy method of applying the therapeutic test—giving quinin and noting the result.

The **prognosis** of malarial fever is good enough if recognized and adequately treated. Failing in this, mild cases often go on to spontaneous recovery. In severer cases the intensity of the outbreaks gradually diminishes and anemia or a chronic cachexia becomes established; or, again, the paroxysms may augment, pass into the pernicious type, and produce collapse and death.

Treatment.—Prophylaxis is the most important measure and will accomplish much, provided the physician is patient and persistent in his efforts and the family is possessed of wisdom, which here, as elsewhere, is rarer than gems. Keeping the child indoors after sundown in a malarial locality, especially when the disease is prevalent, as during spring and fall, is imperative and efficacious. Bedrooms should be upon the second floor, at least—as high up as possible. In quinin we possess one of the real specific drugs, and by its use we may confidently expect complete recovery in cases of malarial fever. The exceptions are rare, and have to do rather with individual hypersusceptibility to the drug or impaired organic activity. The best time to give large doses of quinin is immediately after a paroxysm, and it is usually well

to do this and follow with regular doses of one or two grains (0.065 to 1.13 gm.) three times a day in children under six years of age. George Dock emphasizes the following points, which are in the main embodied in the foregoing treatment:

1. In tertian, quartan, or any duplicated form of these parasites the quinin should be administered in the decline of the paroxysm or before the end of apyrexia. The record of the temperature taken at frequent intervals is a very available and safe guide to the time of administration of the drug. A full dose of the drug, in the form of the hydrochlorate, is administered in capsules. This is followed after a short interval by fifteen drops of dilute hydrochloric acid.

2. In the estivo-autumnal form, where the thermometer fails to show regular remissions, the symptoms being severe, the immediate administration of full doses of the drug is demanded. The fall of temperature or a marked improvement in the subjective symptoms following the full effect of the drug will indicate further treatment, after the manner of the ordinary tertian infection.

3. To prevent relapses a prophylactic dose of quinin should be given every fifth or seventh day following recovery—*i. e.*, every seven days following a mild tertian; every five days following a severe infection.

4. The general consensus of opinion is to the effect that hematuria in malaria is not a contraindication to the use of quinin. Its cautious administration in small doses in such cases is certainly indicated until we have more positive knowledge that it exercises deleterious properties.

For sudden effect or in pernicious cases quinin should be given under the skin; a form recommended for this is the muriate of quinin with urea. In ordinary cases it is better to give the drug distributed rather than in one large dose. The difficulties are in its disagreeable taste and its tendency to produce irritability of the stomach. The best way is to have the quinin in powder and give it in simple elixir, mixing the dose in each instance just before taking. In infants or where the drug is not readily accepted it may be given by the rectum, at least doubling the dose by the mouth. Jacobi says if the attack comes on at regular intervals quinin should be given at a single dose two or three hours before the attack, a dose of five grains sufficing for a child of three years. In attacks occurring at irregular intervals there should be given enough, and a little more than enough—from eight to ten grains in three or four doses during the day. The neutral tannate of quinin is free from much bitterness, but requires two

and a half to three times the dose of the sulphate. For rectal administration no acid should be used, and the better form is the bromid, the muriate, the bisulphate, or the carbamid, and in the form of a suppository. Ointments are uncertain or valueless, but in extreme cases of susceptibility may be tried with lanolin. To disguise the taste of quinin, chocolate or a confection of licorice deserves a good reputation. Cachets are of use, but children are readily taught to swallow pills or capsules with gelatin or chocolate coating, especially if these be flattened spheres.

Damonski reports very favorable results from the use of methyl-blue, ten cases out of eleven terminating in recovery by its use. He used the drug for forty-eight hours at a time, and then subjected the parasite at every stage of its development to the action of the drug. In chronic cases Warburg's tincture has been especially recommended.

Brodnax has found acetanilid a very useful agent to abort the chills of malarial fever. This drug acts well with quinin in some cases. While administering quinin, calomel in minute divided doses is a good adjunct to unload the upper bowel and thus open the way to the absorption of the drug.

EPIDEMIC INFLUENZA.

Synonyms.—Epidemic Catarrhal Fever; La Grippe.

In the last few years epidemic influenza has obtruded itself as a very important disorder in most civilized countries, and is to be found intermittently in nearly all parts of the United States. None of the infectious diseases deserves more prompt and intelligent management, both in prophylaxis and in treatment. Complications and sequelæ demand the most careful and protracted attention. The facts that the infection attacks very young children with great readiness, that one attack can not be said to protect against another, and that the prostration is out of all proportion to the obvious organic disturbance, make it a disorder which calls for the utmost persistence and positiveness at the hands of the medical adviser.

Epidemic influenza may be described as an infectious disease attended by profound weakness and serious catarrhal disturbance of the respiratory or gastro-intestinal organs and many distressing and dangerous nervous phenomena. There is no distinct type of infantile influenza, but it seems marked by less disturbance of the upper respiratory tract, probably because these parts are

less exposed to chill and temperature changes than older children. It is remarkable in that it complicates some diseases and appears to be antagonistic to others, notably scarlatina and diphtheria. Scarlatina seems to be subdued by it into a very mild form. With diphtheria it is apparently never associated, although influenza is frequently accompanied by a form of sore throat, with yellow, pulpy deposit in large masses, closely resembling diphtheria; but in this is not to be found the Klebs-Loeffler bacillus, and it disappears promptly upon treatment, even by local measures only. In the character of their toxic influence diphtheria and influenza have many points of similarity; the extreme depression, slowness of recovery, and susceptibility of nervous tissue mark them as much alike; so, also, the influence of these poisons upon the heart, with the slow or irregular pulse, long maintained and sometimes never quite restored.

Causes.—The essential cause of influenza is now admitted to be a bacillus, for whose discovery we are indebted to Pfeiffer, in 1892, and the isolation of which is attended with a good deal of difficulty. It is a small, specific organism, resembling the bacillus of mouse septicemia, but shorter, with rounded ends. The culture ground seems to be mucous membrane of the nose, throat, and lungs, where it is found in large numbers. The earliest site of infection is usually the throat. There are certain contributory causes pointed out, among which meteorologic conditions are mentioned. The spread of the disease is of extreme rapidity and along the lines of travel.

The bacillus of Pfeiffer is found only in cases of influenza. It is difficult to obtain a pure culture. The influenza poison belongs to the group of bacterial proteins (Buchner)—*i. e.*, poisons which occur in the bodies of the organisms and are not excreted, or only to a limited extent, into the media in which they grow; in this they resemble the diphtheria and tetanus bacilli. The toxin of influenza acts on the central system most powerfully. Locally the effects are exerted chiefly upon the respiratory tract. It does not penetrate to any great depth, and only very rarely enters the blood, as shown by Cantani's experiments.

Mixed Infections.—The bacillus of Pfeiffer is frequently associated with other micro-organisms, such as the pyogenic cocci and the pneumococcus. The bacillus of influenza has been cultivated in the presence of other microbes, especially the staphylococci. In cases of otitis media and inflammation of the membranes of the brain the bacillus of influenza has been found correlated with staphylococci, streptococci, and pneumococci. In the pneumonia of influenza some cases only show the bacillus

of Pfeiffer, others are associated with the bacillus lanceolatus; most commonly the bacilli of influenza are found with streptococci. In some cases there is also associated the tubercle bacillus; and sometimes diphtheria bacilli (Wynekoop). Also cases of obscure clinical manifestation show the influenza bacillus associated with those of scarlet fever, measles, and pneumonia. This will go far to explain variations of symptoms, since the resulting toxins produce varied morbid effects (Sansom).

Diagnosis.—If the disease is not known to be prevalent, the earlier cases are liable to be overlooked, unless of great severity. Ordinary acute catarrhs, however, are rarely so severe or accompanied by such pain and prostration, nor does the process extend to contiguous organs. When influenza is epidemic, there is less difficulty in recognizing an attack, which is marked by rapid onset, sudden and high rise of temperature, and usually evidence of pain in the head or generally about the body or in some limited locality. Cases of sudden irritability of the stomach and intestines, accompanied by head pains and severe fever, may be assumed to be influenza. From pneumonia it may be differentiated by the absence of physical signs in the presence of the general symptoms of chill, cough, etc.; but very soon we may find actual pneumonia as a complication, either when it is thus suspected or following mild attacks of catarrhal fever, when not anticipated; and yet characteristic physical signs will be demonstrated upon search. Often the case presents a complete picture of pneumonia, with, however, an absence of the dullness on percussion, when, in true pneumonia, auscultation would have led us to expect it.

Influenza resembles measles in its onset, both in catarrhal symptoms and sometimes in the rash. At other times scarlatina is simulated by the throat symptoms, along with a scarlatinal rash, both usually of short duration. When the lung symptoms or the febrile movements are protracted and severe, miliary tuberculosis may be feared. Typhoid fever closely resembles catarrhal fever, even in the matter of eruption; but the rose-colored spots in catarrhal fever are more numerous, extend over larger areas, persist longer, and remain as slightly brown discolorations for some time after fading. The fever, moreover, is more irregular than in typhoid, nor do we see the apathetic face so constantly, the countenance being flushed in influenza and pale in typhoid. The mind, moreover, is clear; the temper is often irritable. The temperature in influenza frequently shows an evening fall and a morning rise (the reverse of typhoid progression), and often there are a marked rise and fall at periods of a

week. Oftentimes meningitis and influenza are scarcely to be differentiated, though in true meningitis the muscles of the neck and back exhibit a characteristic and intense rigidity, of a persistence not seen in catarrhal fever. The diagnosis may be delayed during the progress of ill-defined and mild symptoms, but is made known by the feebleness of the child during convalescence, especially by a weak, irritable heart and disabilities of various sorts, especially for sustained exertion.

Upon the gouty subject the influenza poison produces peculiar and perplexing symptoms, modifying in some adverse way the faulty metabolism in those so disposed. If added to acute rheumatism, it is a serious combination, and may profoundly aggravate existing lesions of the heart, previously unsuspected. Sansom is of the opinion that the influenza poison does not itself produce endocarditis, although in a case one of the authors saw in consultation with Dr. Vallandingham, of Delaware, a boy of nine, suffering from marked endocarditis, had no history of rheumatism or previous heart involvement. Althaus, in a study of the influenza in the German army, and Parvinski found only endocarditis in those not free from suspicion of previous disorders.

The arthritis which in some cases accompanies and in others follows upon influenza is probably a simulated, not a real, rheumatism.

The relationships are exceedingly puzzling and misleading, but seem to be rather of the nature of osteo-arthritis and have not the associations of true rheumatism. There may be rheumatism without painfulness, as witness the morbid changes occurring in the endocardium of the fetus without the mother participating in the disease. Rheumatic affections of the heart often exhibit a protracted course and show little or no subjective symptoms.

Pericarditis may come and go unnoticed, yet leave permanent adhesions and myocardial damage. Endocarditis, too, may be accompanied by changes unattended by subjective symptoms, such as alterations of the endothelium, formations of vegetations, exudations, and thickenings, fibrosis, and contractions, calcareous deformity and degenerations, lasting many months or years.

The myocardial changes may also be profoundly affected, the whole heart being involved (the "general carditis" of Sturges). (See Rheumatism.)

Many forms of nonrheumatic arthritis are known and described in connection with mumps, typhoid fever, dysentery, and certain acute diseases of the nervous system. Scarlatinal arthritis is not a rheumatic affection. "The rheumatic heart is in a state

of permanent disease, long-continued liability to organic disease; the nonrheumatic heart of arthritis is affected with, or liable to, disorders of its nervous mechanism, but not to essential organic disease of the endocardium, pericardium, or myocardium" (Sansom).

Prognosis.—Influenza is a very fatal disease, partly from the virulence of the toxin generated in the blood, which may kill outright, and partly from the devitalizing effects wrought upon the great organs, and also from its serious sequelæ and complications. In children these resulting effects are milder and more limited than in adults; neuritis is rare. Persistent nervous cough is perhaps the most frequent. Gastric influenza with profuse nervous vomiting occurs in very young children; there is also an influenzal dysentery, most persistent and depleting. The mortality varies in different epidemics, and in some of them children are more affected, in others adults. Death results in most cases from paralysis of the diaphragm (Allyn). All kinds of children are apparently attacked indiscriminately. So sudden is the fatality that sunstroke and malignant malaria or scarlatina may be suspected. The digestive and respiratory organs may escape, the poison overwhelming the nervous system. Weaker children naturally succumb more readily. Robust children, however, are frequently changed into frail, feeble beings for years or for life.

Symptoms.—The usual form of the influenza attack is a severe catarrh of the upper respiratory organs, often beginning with sneezing, sometimes as a laryngitis, less frequently as a tonsillitis, and rapidly extending to the throat and lungs, along with pains in the head or elsewhere, neuralgias or myalgias, disturbances of the heart action, and extremely irregular fever. The next in frequency (perhaps as frequently in children) is acute gastritis or diarrhea, or both, also associated with pains and the other symptoms described. The third form depends upon involvement of the brain or nervous system. It is manifested by irritability and fretfulness (almost pathognomonic), or there may be hebetude, or rather apathy, from which the child is easily roused, and is then fairly bright, not slow and dull of speech as in typhoid fever; occasionally convulsions or coma vigil is seen. At first there may be chill and delirium, possibly a convulsion, and usually extremely rapid, more or less irregular, pulse. At once the temperature begins to be flighty and may run high, but not, as a rule. There may be a persistent temperature of 101° F. (38.3° C.) or thereabouts maintained for a long time despite all efforts to reduce it. This may alternate with or soon be followed

by subnormality. All these three groups of symptoms, or so many of them as are not masked by the others, may occur together or in rapid succession. Headache or other pain is evidenced only by the child putting his hand to the suffering locality, or there may be only a tenderness on being touched. The conjunctiva is often irritated, and tears are secreted in excess.

The respiratory catarrh is liable to extend alarmingly, involving first one lung, then the other, producing severe bronchitis or bronchopneumonia, which sometimes clears up unexpectedly or swiftly destroys life, largely in proportion to the not to be predicted severity of the toxemia or the resistance and vigor of the child.

When the digestive organs bear the brunt of the attack, exhaustion is from a double cause. Malnutrition is severe, appetite is often lost after the vomiting or diarrhea is controlled, and a wretched picture of collapse and emaciation is presented.

Complications may involve any and every organ in the body. Tuberculosis is liable to infect the thus depraved constitution. Middle-ear disease often occurs; the skin is also variously affected by herpes, erythema, and urticaria. Rheumatism, or rather painful arthritis, is a common and distressing feature. The kidneys suffer, but not often severely. The bones are affected occasionally (a periosteitis). Those children having a tendency to rickets are liable to develop it or suffer an aggravation of usual complications. Glandular enlargements are common and persist.

Empyema almost never follows upon the poison of influenza unless complicated by other cocci. Also it is rare for tubercle to follow the condition in children. Neuritis rarely follows influenza in children, whereas it is a common sequel in adults (Curtin). It is an interesting fact, pointed out by Curtin, that in the epidemic of 1889 there was a markedly inverse ratio between the prevalence of influenza and malaria. As the epidemic increased malaria lessened rapidly in regions where it commonly prevailed, and returned as the influenza subsided.

As a rule, the younger the child, the less characteristic are the phenomena. In the very young gastric symptoms prevail. The spleen is sometimes enlarged; albuminuria occasionally appears.

Treatment.—Prompt and efficient isolation with full means for disinfection is demanded from the start.

To this there should be no demur nor temporizing, though neither the public nor the health authorities fully realize this yet. The treatment must be symptomatic, and among the first

comes relief of pain. During the stage of high fever repeated hot foot-baths are most grateful; and aconite tincture, ½ to one minim, carefully watched, may be given every ten or fifteen minutes, or soon to be followed by the coal-tar antipyretics (for only temporary use), and next full stimulation by champagne or spirits in water, hot or cold, at short intervals; also concentrated foods until the stomach can receive more substantial fare. Full feeding is to be given soon and persistently, and the stomach may well be reserved for the purpose while gastric irritability continues; medicines are better then given hypodermically or by the rectum.

For the respiratory catarrh a combination of atropin, morphin acetate, heroin, or codein, in small repeated doses, gives great comfort. This had best be accompanied by strychnin or digitalin to sustain the heart. Quinin is also indicated, the hydrochlorate best and by the rectum. For vomiting, bismuth subcarbonate may be given in chloroform or peppermint water or cinnamon water. For very severe gastritis cocain will often relieve, $\frac{1}{30}$ or $\frac{1}{20}$ of a grain being given every half-hour. (See Gastritis.) A prompt action from calomel, $\frac{1}{10}$ of a grain every half-hour, is certainly useful here. The hot foot-bath helps this, too, as does mustard to the epigastrium or neck.

Phenazone is a good analgesic and expectorant for stronger children, and this or phenacetin, along with sodium salicylate, or, better, cinchonidin salicylate, every two or three hours, will relieve the myalgia, but it may derange the already irritable stomach. For intense muscle pains the hot-pack or steam-bath, general or local, is comforting; for painful limbs external applications of methyl salicylate, followed by the flannel bandage.

Convalescents demand the most watchful, persistent care. Here the great stand-by is strychnin in increasing doses (up to the verge of toxic endurance when great depression persists), and long-continued tonics and nutrients, persistent overfeeding, predigestion, measured amounts of easily digested foods, meat-extracts, tonics of various sorts—hypophosphites, the organic phosphorus products, cod-liver oil, and, above all, change of air, which is always demanded in tardy or incomplete convalescence.

EPIDEMIC CEREBROSPINAL MENINGITIS.

Synonyms.—Spotted Fever; Malignant Purpuric Fever.

Epidemic cerebrospinal meningitis belongs to the list of infectious fevers which occur epidemically and sporadically; it attacks

not only human beings, but animals, both those in health and also, and more readily, those who are exhausted by disease and other depressing circumstances. The disease is characterized by inflammation of the cerebrospinal meninges, and clinically is of irregular course. Adults as well as children are affected, but the young are much more susceptible.

Causes.—Epidemic cerebrospinal meningitis arises suddenly, without warning, in the form of an epidemic, which may attack only a few individuals here and there in a community or create wide-spread havoc. The specific cause is the micro-organism described by Weichselbaum in 1887, which received little attention until, in 1895, Jaeger, followed by Councilman, confirmed his findings, and later, and more fully, in 1899, Osler added further proofs that the disease is dependent upon infection by the diplococcus intracellularis meningitidis. It is found alone, but is frequently associated with other micro-organisms, such as the streptococcus and pneumococcus. Overexertion, depressing mental or bodily surroundings, poverty, and unhygienic surroundings act as predisposing causes.

Pathology.—If death occurs in the earlier stages of spotted fever, the lesions are slight, but if later, the appearances of the meninges of the brain and spinal cord exhibit evidences of intense hyperemia. If the case has lasted somewhat longer, pus is to be seen under the arachnoid. This membrane appears cloudy, especially along the course of vessels from which the exudation doubtless takes place. This purulent exudate covers not only the tissues of the convexity, but may extend to the base, in the meshes of the pia, and between it and the cortex. A layer of exudate can often be found over the greater part of the spinal cord. The fluid in the ventricles is, as a rule. increased, and may contain small flocculi of fibrin. Hemorrhage may likewise take place in various parts of the pia mater and underlying tissues. The other organs of the body are liable to be affected in such a way as is common to infectious diseases, by hypostasis, hemorrhage, and inflammations generally. Septic involvements of the joints are occasionally seen, multiple abscesses also, and even parenchymatous degenerations of the kidneys, liver, and spleen. The dusky spots or mottling occasionally seen, and which give the disease the name of "spotted fever," may also be found in the internal organs.

Symptoms.—The characteristic feature of spotted fever is its suddenness, as if the poison came out of a clear sky. The progression of the symptoms is very like those of the other forms of meningitis, except that they are developed much more rapidly.

A child in perfect health is suddenly smitten with headache or chill, accompanied, it may be, by dizziness, vomiting, or convulsions. If the case is a mild one, these features are not so pronounced, but usually the earlier symptoms are quickly followed by stupor, which rapidly develops into profound coma. Often this coma is deep from the beginning, and may alternate with delirium; in the lesser cases a distressing restlessness or twitchings may replace both, accompanied by hyperesthesia. The headache may be replaced by neuralgic pains, especially at first. The vomiting is an early, common symptom and cerebral in character—a sudden gushing-out of the contents of the stomach and in such quantity as is almost unaccountable. The pupils are unequal, generally dilated; strabismus is common, and photophobia is a marked feature. The fever begins quite high and runs up to 103° or 105° F.(39.4° to 40.5°C.), but not always; in some cases it is never very great or may be actually subnormal. Sudden rises in temperature usher in serious symptoms. Delirium is rarely absent, and varies from wild excitement to somberness, and in a measure indicates the gravity of the disease. Tenderness of the flesh to touch is common, extending down the spine or along the limbs, sometimes localized to one set of nerves and then shifting elsewhere. As in other forms of meningitis, retraction of the head may alternate with clonic spasms and produce complete opisthotonos or merely local stiffnesses. Clonic spasms are frequently met, from a simple twitching to continued subsultus tendinum, and may be the forerunner of convulsions. Kernig's sign is to be found, as a rule. To obtain this, place the patient in a sitting posture and endeavor to extend the leg upon the thigh, and it will be found that the flexors contract, preventing the straightening of the leg; or, again, let the child lie upon its back and flex the thigh upon the abdomen, and try to extend the leg forcibly, and the flexors will be found to contract and maintain the leg at a right angle. Paralyses arise, either of central origin or peripheral, and are transient or continued. The reflexes vary and are not significant, except of local disturbances. Sensory impairments, as of sight or hearing, occur temporarily or remain, and on the recovery of the individual the sense organ may be found functionally destroyed. Photophobia is sometimes distressing. Respiration is usually much disturbed and varies greatly: in the beginning hurried, and later very slow; at other times interrupted or jerky, and toward the end, in fatal cases, of the Cheyne-Stokes type. This last must be regarded, however, as not so hopeless a symptom in children as in adults. Diseases of the lungs and pleura, also of the heart and kidneys, must be constantly watched

for. The pulse in cerebrospinal fever is rapid in children, as a rule; in adults, in the later stages, it may be slow. The skin shows characteristic mottlings, usually of a dark purple, and oval in shape, from ⅓ to ½ of an inch in diameter, and small red and large bluish exudations. These do not fade on pressure. Cutaneous hyperesthesia is often noted, and the skin is sore to the slightest touch, either very hot or in other instances quite cool to the hand, and sometimes bathed in perspiration. Constipation is usually present, and should not be neglected. Inflammatory diseases of the eyes are often met, such as iritis, keratitis, and choroiditis; also diseases of the ear and the joints.

Diagnosis.—The prevalence of an epidemic of conditions resembling spotted fever, along with the development of cerebral symptoms, will awaken a grave suspicion. If, upon examination of the cerebrospinal fluid, the diplococcus intracellularis meningitidis is found, the diagnosis is established. Repeated observations of the fluid by microscope may be necessary, or, better, a bacteriologic examination will make the matter certain. Cerebrospinal fever may be mistaken for scarlatina in its very early stages because of the eruption, which in scarlatina is so often noncharacteristic in its distribution. The throat symptoms and frequent nephritis are to be differentiated in the latter. From other forms of meningitis it is oftentimes most difficult to distinguish, unless the eruption shows itself early in its characteristic small red or larger bluish or purplish spots which do not fade on pressure. The epidemic form, also, is usually much more abrupt in onset, more acute, and is accompanied by marked hyperesthesia.

Prognosis.—Cerebrospinal fever is one of the most fatal diseases of childhood; about one-half recover, and, unfortunately, when recovery does take place, so damaged are many of the organs that the survivor is likely to be lamed for life in many ways, as by deafness, blindness, and local palsies. The complications which may arise are limitless; extensive ecchymosis is an evidence of blood dyscrasia and a fatal sign. Prolonged high fever and convulsions not only threaten life, but are liable to leave serious structural damage upon the brain and cord, with their attendant results, as epilepsy and the like.

Treatment.—The general measures to be employed are those applicable to any case of infectious disease, to which may be added the rational treatment outlined under simple cerebrospinal meningitis. The first thing to be considered in cerebrospinal fever is preventive treatment, over which we may or may not have control, since the contagiousness of cerebrospinal fever is not

proved. During the prevalence of an epidemic children had best be guarded from contact with suspected cases and from exposure to extremes of heat and cold. Undue bodily and mental fatigue should be avoided, and they should be supplied with simple, well-selected food. In the use of counterirritants for the treatment of this disease care should be used not to allow blistering, because the trophic changes are so profound that healing is delayed unduly. There is no specific remedy, and we can only treat symptoms as they arise. The indications are to relieve intense congestions and meet emergencies. Absolute quiet and rest are first to be secured. Dry cups applied to the neck and back, on each side of spine, are of some value to relieve internal congestions of the meningeal vessels; ice to the head and hot baths to the body will aid in relieving the hyperemias and will mitigate the headache. In certain cases when there is evidence of great intracranial tension, lumbar puncture may afford much relief to symptoms, especially of pressure and pain. The bowels should be emptied by enemata or calomel. Should the temperature be above 102.5° F. (39° C.), cold sponging is indicated, just as in any other fever; for hyperthermia the cold pack. In view of the constant vomiting, medicines are best administered by enema or hypodermically. Chloral by enema, three to five grains, and ergot hypodermically, may be used to influence capillary congestion. Hyoscin hydrobromate seems of distinct value to relieve muscular spasms, restlessness, and insomnia, in doses of $\frac{1}{600}$ to $\frac{1}{300}$ of a grain, and is less likely to produce depression than chloral. Opium is one of the safest and most reliable remedies, preferable in the form of morphin hypodermically ($\frac{1}{48}$ to $\frac{1}{12}$; second doses, if the first are found to be ineffectual, should be double the first), along with hyoscin hydrobromate or atropin. During the stage of convalescence it is important first to use whatever will aid in the absorption and elimination of the seroplastic or seropurulent exudate. Potassium iodid is usually needed, given in lithia or other alkaline water or in the solution of ammonium acetate. For this purpose also, as well as to stimulate intestinal atony, turpentine is of value. Nutrient tonics, especially cod-liver or olive oil by inunction, along with massage very gently begun, are of great use in the repair of tissue waste, especially in the nerves. Hot and cold bathings are useful to the weakened parts, and better than electricity for the paralyses.

MUMPS.

Synonym.—Specific Parotitis.

Mumps is an acute specific infectious inflammation, characterized by pain and swelling of the parotid glands, with occasional (rare) metastasis to the mammæ, ovaries, or testicles. It runs a definite course, and one attack usually confers immunity.

Causes.—The cause is evidently a specific poison, which as yet no one has succeeded in isolating. The germ enters probably by the mouth, reaching the parotid gland by Steno's duct. This disease is observed in all lands, at any time of the year, but is most common in these latitudes during the fall and winter. Males are more liable than females, and the most susceptible age is between the third and fifth years. The period of incubation is generally two weeks.

Symptoms.—These vary, depending on the nature of the epidemic and of the individual attacked. The stage of invasion lasts from twenty-four to seventy-two hours. The local symptoms usually have a duration of from eight to thirteen days, during which time complications may set in. The stage of invasion is accompanied by a rise of temperature, malaise, some loss of appetite, and occasionally vomiting. The first local symptom is a pain in the space between the mastoid process and the lobe of the ear. Very soon this painful spot increases in size, until the whole region around the ear becomes affected. As a rule, the swelling begins in the same place in which the pain is first noticed, and the enlargement becomes general, usually in from three to six hours after its first appearance. Both glands are not attacked simultaneously; it begins in one and has time usually to run its course of inflammation, to be followed in a few days by the enlargement of the second gland. Upon the characteristic swelling and its accurate observation depends the correctness of the diagnosis. Much consolation may be derived from the reflection that the acme of the process is attained very quickly and is short lived. The principal complication of this disease is an inflammatory enlargement of the testicles (orchitis), spermatic cord, and inguinal glands in males, especially liable to occur about the age of puberty, and in females an involvement of the ovaries, labia majora, and mammary and inguinal glands. These are, in our experience, rare. Complications do not, as a rule, appear until the inflammation of the parotid gland has subsided.

Diagnosis.—There is but one gland that lies around the ear,

—*i. e.*, in front of the ear and following its outline, not only anteriorly, but below and behind,—and when this swelling is localized as to this general outline, we are dealing with only one disease—parotitis. It is common to learn of other cases in the vicinity, and this helps the decision.

Prognosis.—When the inflammation is uncomplicated, the prognosis is favorable, one of the chief dangers being edema of the glottis, or, as occasionally happens, the parotid gland may break down, forming an abscess. When metastases arise, as to the mammæ, ovaries, or testes, the prognosis is not so favorable. Although rare in our experience, such conditions are painful, and while considerably lengthening the duration of the disease, they do not, as a rule, cause serious danger to the individual. Still, the possible complication of mumps warrants great care during an attack to guard against chill, fatigue, or digestive disturbances.

Treatment.—This is palliative and expectant. The diet should be liquid for a week. Pilocarpin, used in some cases and claimed as a specific, has met with varying success. Warm or hot applications to the swollen glands, as hot olive oil applied on cotton, will almost always prove acceptable to the patient. When the pain is considerable, small doses of an opiate, as Dover's powder, may be given, combined with phenacetin or salol. The bowels should be kept open, and when the fever is high, it may be reduced by sponging the body with cool water —70° or 80° F.—or by suitable doses of aconite or other febrifuge remedies. As a general rule, it is well to keep the child quarantined while the disease is in progress, as its infectiousness can not be questioned; neither should parotitis always be treated carelessly as an insignificant disease, as occasionally cases of fatal gangrene of the parotid and cervical glands have been reported, and Joffroy has mentioned a case in which peripheral neuritis followed, with paralysis of the extremities lasting four months.

For glandular involvement the inflammation is relieved by various local remedies, as lead-water, laudanum, menthol, or witch-hazel, and the like. Ichthyol, 25 per cent. in lanolin, is soothing and detergent. Painting with menthol is recommended. All measures should be supplemented by support and rest. Packing in dry cotton-wool answers very well.

To an inflamed testicle, the application of faradism is said to aid in preventing atrophy after the acute condition has lessened or subsided.

WHOOPING-COUGH.

Synonym.—PERTUSSIS.

Whooping-cough, or pertussis, is an acute infectious and highly contagious disease of early childhood, occurring sporadically and epidemically, characterized by a catarrhal affection of the respiratory tract and a characteristic paroxysmal cough which threatens suffocation. It leaves a peculiar vulnerability of the mucous surfaces of the bronchi and intestines, which should never be lost sight of by parent and physician. It spreads with great rapidity through a community, especially in the cold months, attacking the youngest most readily, and infecting nearly all those not immunized by a previous attack. Such immunity is almost complete, second attacks occurring only as rare and isolated instances. Children who are much in the open air or living in well-ventilated houses, as in the wards of large hospitals, asylums, and the like, escape more readily than when crowded in close quarters. Infection is almost entirely from direct and immediate contact, but the slightest exposure at short range will suffice. Mediate contagion is most unusual. Whooping-cough is an exceedingly fatal disease, ranking in deadliness to infants next to scarlet fever and diphtheria. It affects babes under six months with the utmost readiness, differing from the exanthemata in this respect; indeed, its ravages are chiefly confined to children under two years, and it is not of frequent occurrence above four years of age and comparatively rare after ten.

The essential cause of whooping-cough is most probably a micro-organism, but what this is has not been exactly determined. Many contributory causes are recognized, of which the age of the patient, as already mentioned, is one of the chief. A depressed state of health is another, and there is some well-recognized but unexplained relationship between epidemics of measles and whooping-cough which predisposes those suffering or recovering from measles to contract this specific cough. The presence of any other diseases does not interfere with its acquirement. Some children are never infected, though often exposed; a few cases occur late in life.

The lesions of whooping-cough are varying degrees of catarrhal inflammation, affecting the mucous membrane of the upper respiratory tract, especially the larynx and trachea. Catarrhal enteritis and colitis are common sequels.

Incubation.—A precise statement of the period of incubation is impossible. It is safe to estimate the latent period as from

one to two weeks, but the onset is too gradual and the initial symptoms often too ill defined to admit of greater accuracy. It is probable that here, as in many other infectious diseases, the incubation period is variable, depending upon personal systemic conditions and susceptibilities and perhaps upon atmospheric and telluric conditions as well. Usually several days elapse before the peculiar characteristic whoop is heard. The infective period also varies, from the very beginning of the catarrhal stage to the end of the spasmodic stage or cough. Quarantine should be insisted on for full three months.

Symptoms.—It is important to distinguish between at least two stages of whooping-cough, the catarrhal and the spasmodic. Sometimes a third more arbitrary stage is described, that of decline. The first—premonitory, catarrhal, or feverish—stage lasts a week or more. The child is "poorly," with slight fever and a dry, ringing cough. The cough of this stage is not materially different from that due to simple catarrh, but occurs with more virulence at night, often keeping the patient awake and struggling to repress the disagreeable tickling sensation in the throat. Ordinary cough remedies have little effect in repressing this. In the daytime the child may be fairly well, perhaps with diminished appetite and not quite up to normal health. Auscultation of the chest reveals a condition of bronchitis, with a considerable number of bronchial rales, both dry and moist, but there is little evidence of secretion from the bronchi. Gradually the cough becomes more and more paroxysmal, and the child passes insensibly or gradually into the second or convulsive stage. At the end of the second week, or it may be after only a few days, the characteristic whoop occurs; the cough returns in repeated paroxysms; the onset of the paroxysm is very sudden: a series of rapid expiratory coughs occur; these are at once followed by a short and distinct "whoop," or long, noisy inspiration; then succeeds another series of expiratory coughs, similar to the first, followed by a louder "whoop," and so on for three or four attacks, until the child is quite worn out. The attack frequently ends by severe vomiting. It may readily be seen how forty or fifty such paroxysms during the course of twenty-four hours, many or most followed by regurgitation of food, will greatly exhaust the child, and as the disease continues for a long period, pertussis is rightly to be dreaded. As has been before stated, the termination of a paroxysm is denoted by eructation and vomiting of bits of food, stringy mucus, and sometimes small quantities of blood. During the coughing-fit the face becomes dusky and cyanosed—indeed, all through this stage, owing to the

frequent and severe coughing, the face presents a peculiar livid appearance and the eyes are swollen and watery. The duskiness of the skin is due to capillary congestion, and often there are extravasations of blood into the conjunctivæ, the whole conjunctival surface sometimes becoming blood-red. A sharp bleeding from the nose often accompanies or follows the paroxysm. Sneezing is a common phenomenon, sometimes replacing the cough for longer or shorter periods. After this stage of four or five, sometimes seven or eight, weeks, the paroxysms grow less in number and severity, the "whoop" disappears, the lungs clear up, and convalescence is established. A slight ulceration of the frenum of the tongue is often noted.

Complications and Sequelæ.—The most common and dangerous complications of pertussis are bronchitis and bronchopneumonia. These occur oftener in the summer months. Atelectasis of a portion or the whole lung may prove a fatal complication in very young children, especially those of strumous or rachitic type. Occasionally pleuritis with effusion or croupous pneumonia arises in the latter stages, and empyema has been observed. Emphysema is not a very rare complication where the amount of coughing is great, but this usually passes away entirely. A much rarer complication, and one fraught with sudden and great danger, is edema of the glottis. A number of small grayish or yellowish-gray ulcers are frequently found upon the frenum of the tongue, having small significance and bearing no relation to the severity of the attack. While vomiting is a symptom commonly present and usually ends a pronounced paroxysm of coughing, it may become of such frequency and severity as to endanger life by producing starvation. Chronic diarrhea, also, may be a late and stubborn sequel. A certain amount of hemorrhage from the lungs not infrequently accompanies the paroxysm in severe cases, but more often there is bleeding from the mouth and ears. Cases of true gastric hemorrhage, while very rare, have been reported. An effusion of blood may also take place into the meninges. Hemorrhage into the subconjunctival tissues is not at all unusual. Epistaxis, frequently repeated, tends seriously to deplete the sufferer. The nervous sequelæ of pertussis are sometimes severe; convulsions, especially in young children, may cause death, but are not common. Spasm of the glottis, aphasia, hemiplegia, and loss of vision of a more or less transient sort, occur quite often. During the attack of coughing involuntary passage of urine and feces may take place, and the congestion of the kidneys, which during the disease is always markedly present, may possibly result in a true nephritis,

parenchymatous in nature. This sometimes persists long after the disease itself has subsided. Cases have also been reported in which diabetes mellitus has followed the attack of whooping-cough. Glandular enlargements, particularly those of the bronchial glands, are not uncommon. Relapses or recrudescences of whooping-cough have been observed.

Diagnosis.—In the beginning it is practically impossible to differentiate whooping-cough from ordinary catarrhal states unless the whoop appears. When once this is established, there need be no difficulty. However, in the absence of whoop a prolonged severe cough and catarrhal state, with freedom from fever, the increments appearing at night and being of a spasmodic character, emphasize suspicion. Children may have whooping-cough yet never exhibit the characteristic whoop.

The disease is probably of microbic origin. Afanassiew in 1887 isolated a bacillus which he called the bacillus tussis convulsivæ, and other investigators have substantiated his opinion. The germ has been found principally in the mucus of the trachea.

Pathology.—Henry Koplik first and, independently and soon after, Czaplewski and Hensel have recorded as constant in pertussis a facultative anaërobic bacillus resembling in its morphology the influenza bacillus, but somewhat larger.

Vincinzi also describes a small, immobile, coccus-like bacillus resembling the influenza bacillus, constant in a series of cases of pertussis. Behla later came to the conclusion that the exciting cause of whooping-cough is a micro-organism, not of a bacterial nature, not found in the blood or epithelium, and not possessing an intracellular growth, but belonging, as Deichler and Kurloff also believe, to the protozoa, its whole deportment testifying that it is an ameba, increasing by division aud presenting the formation of spores.

The immediate cause of the paroxysms of coughing is undoubtedly a supersensitive condition of the mucous membrane of the air-passages, which is supplied by the superior laryngeal nerve. There are few pathologic changes to be found postmortem in the various organs. Those most commonly seen are due to congestions, especially in the lungs, heart, kidneys, and meninges. Occasionally after death patches of atelectasis or pneumonia are to be found in the lungs or hemorrhages into these organs. The pathologic effects of the poison are manifested chiefly on the nervous and the lymphatic system.

Treatment.—The treatment of whooping-cough should be both local and systemic. The infectious principle enters by the upper air-passage, and hence carefully directed and persistently

applied local remedies can be relied on to modify or check the disorder, and our experience encourages us to believe this to be a most important factor in treatment. Children can soon be trained to submit to the application of aseptic and soothing sprays and other local medications: even to welcome them for the relief they afford. Those who object should be persuaded or held in position for intubation, advised by Walter Freeman. It is well to spray or douche the nose with a cleansing solution, preferably alkaline and approximating the specific gravity of the blood, to which may be added various stimulating or astringent ingredients suited to the stage of the disorder or the local conditions of the mucous surfaces, repeating several times a day. This may be followed by oily sprays containing menthol or camphor. When relaxation is obvious, astringents are indicated, of which sulphate of zinc or alum is useful, in tincture of rose or pomegranate. Later iodin in glycerin is of value to alter the glandular action, applied on a cotton swab. Cocain and antipyrin, in weak solution in an aromatic water, applied to nose or pharynx, greatly relieve certain cases. Cocain is not of much use, however. Extract of hamamelis is of value. The use of acidulated solutions of quinin, both locally and systemically, was suggested to one of the authors by Edward Watson, and proved of greater value than any other remedy.

To relieve vomiting Baginsky recommends menthol, from $\frac{1}{10}$ to $\frac{1}{6}$ of a grain rubbed up in white sugar every two hours.

The length and severity of the spasm are greatly checked by inhaling a mixture of three parts chloroform, five parts ether, and one-half to one part amyl nitrite. A few drops of this are applied on a handkerchief and held under the nose on the instant of coughing, and has proved of great service in our hands and never gave rise to any anxiety; indeed, it has apparently saved life often. Internally the great remedy is quinin, preferably in solution, with hydrobromic acid. Thus is obtained both a local and systemic effect, and the dose is best given at frequent intervals of not less than two or three hours. If this does not suffice, atropin or hyoscin hydrobromate, in a dose of $\frac{1}{1000}$ to $\frac{1}{300}$ of a grain every two hours, is of value. Bromoform is highly extolled by some, especially the French, and is of much value. An opiate in the form of codein or Dover's powder checks coughing best at night.

One of the recent remedies much extolled is an ointment of difluordiphenol, one or two drams a day, rubbed into the skin.

To quote from one of the authors, it is important, "First, to begin treatment as early as possible, especially with local measures. In certain instances I was of the opinion that beginning

attacks were thus aborted. Second, it seemed of value to meet the toxin by small repeated doses of calomel with bicarbonate of soda or boric acid, or both, to expedite action of the kidneys. Third, the diet should be simple, carefully prepared, and given in small amounts at a time, so as not to overload the stomach or overtax the digestive capacity anywhere. If vomiting occurs, food should be offered soon after,—a half-hour or an hour,—for very rarely it is accompanied by nausea; it is merely a reflex spasmodic rejection of food, and starvation is thus easily induced. For very profuse vomiting in older children I occasionally use small pills of cocain, $\frac{1}{60}$ to $\frac{1}{40}$ of a grain, along with two grains of cerium oxalate. Fourth, the local measures, as outlined above, must be promptly, thoroughly, and frequently applied. Fifth, children afflicted with pertussis should live all day in the open air, adequately clothed. If the weather is exceedingly inclement, they may play about in a room with all the windows open, clothed as if for the open air. Sixth, the question of climate is a relative one which can be met within four walls if the proper conditions are obtained. This can be accomplished by maintaining a proper temperature and relative humidity. Too great dryness, if artificial, is distinctly objectionable. Sometimes the seashore is best, but more often a wholesome piece of woodland will suffice, especially if it consists largely of the conifera. Dry, sandy soils are much better than alluvial ones, but there should always be an abundance of outdoor air both by night and by day, and as little as possible of fatiguing conditions, such as school tasks induce."

The most potent factor in the disease, both in children and in adults, is the spasm of the glottis. Intubation by O'Dwyer's tubes has been employed with great satisfaction to relieve profound spasm of the glottis.

Norton tried the use of carbonic acid gas by the rectum upon 150 cases. Of these, 143 were apparently benefitted. The vomiting ceased after the second or third administration in even very severe cases. A slight diarrhea resulted in a few instances, attributable possibly to irritation of the rectal canal.

Attention has been called to the use of vaccination in cases of pertussis; it seems of undoubted value, especially in those not previously vaccinated, effecting a cure in about two weeks.

SYPHILIS.

Syphilis is a specific disease, probably of microbic origin, of slow evolution, engendered by inoculation (acquired syphilis) or

by transmission from parents (congenital syphilis). In congenital syphilis (excepting only the primary sore or chancre) all features of the acquired disease may be manifested. Syphilis arising in infancy may, however, be acquired possibly from a sore on the genital tract of the mother, from lesions in the nurse or attendant, especially a mucous patch upon the mouth or lips.

A babe infected with syphilis may come into the world healthy looking or with obvious evidence of the disease; generally no symptom is shown until a month or more has elapsed. Syphilis may be acquired from the father or mother, or from both, infecting through the spermatozoa of the male or the ovum of the female. It is generally admitted that if infection arises from a double syphilization, from both an infected father and mother, the result is more disastrous to the offspring. There is the greatest danger from paternal transmission during the first year after primary infection, and it is possible up to the end of the fourth year. Early and thorough treatment greatly lessens the probability of transmission, but after a certain time this immunity is lost. A mother may bring forth a syphilitic child without herself giving evidence of having acquired the disease. Colles' law, well established, is that a mother bringing forth a syphilitic child can not acquire the disease from the infant, and, further, she is immune to syphilis from any source. If a mother is suffering from constitutional syphilis, the disease is transmitted in an unusually active form to her offspring. The degree of severity depends upon the stage of syphilization, character of the disease, and the nature of the treatment employed.

Symptoms of syphilis at birth are feebleness of the infant, malnutrition, usually certain skin eruptions in the form of bullæ about the wrists and ankles, and pustular syphilids on the feet and hands, ulcerated lips, nasopharyngeal catarrh, and enlargement of the liver and spleen.

Early Manifestations.—(1) Those cases which develop the disease at birth or very early after birth; (2) those which develop it one or two months later.

1. When the disease manifests itself early after birth, the attack will be severer; in other words, the earlier the attack, the graver the disease. The usual symptom-group is emaciation, a severe form of coryza, and an eruption of blebs, particularly upon the palms of the hands and soles of the feet. Certain fissures and ulcerations appear on the lips, which are characteristic and are a source of infection to wet-nurses. There are also signs of bony and visceral disease, disturbances of nutrition, with consequent atrophy of all the structures of the body, and

the infant presents the countenance of an old man. All this is due to the direct influence of the syphilitic virus. Skin eruptions are similar to those appearing late in the course of the disease. These children rarely survive long.

2. When a syphilitic babe is born seemingly healthy, without any sign of abnormality, it thrives well, or apparently so, and may remain thus for a month or two, when a nasopharyngeal catarrh usually develops, producing the characteristic snuffles and interfering seriously with the act of nursing. This catarrhal condition may extend to the Eustachian tubes or middle ear and thus cause deafness. In the graver forms of syphilis the discharge may be seropurulent, evidencing ulceration; necrotic changes take place in the bones, with local loss of tissue, producing the characteristic flat nose of congenital syphilis. The protoplasm of children reacts readily to irritative processes, and the syphilitic poison produces extensive changes and ravages in the tissue; hence, the very remotest parts are affected and with a wide variety of phenomena. The skin-lesions develop along with or soon after those of the mucous membranes. One of the earliest is the eruption of small, round, or oval pink macules, disappearing on pressure and occurring upon the lower part of the abdomen or nates, spreading thence over most of the body. The color of the erythematous rash has a tendency to become like that of copper, and yet the resemblance to a simple erythema is very close. Usually there is little or no scaliness, except at times on the hands or feet; at others this eruption tends to grow worse, showing moist, infiltrated patches, closely resembling eczema.

A papular syphiloderm usually accompanies the erythema, in the shape of small, dull, red papules running together. When lesions occur near the mucous orifices, especially about the anus and commissures of the lips, condylomata may result and are highly contagious. There may also form rhagades or linear scars radiating from the mucous junctures. Pustular syphiloderms begin as early as the eighth week, but usually later. The pustules may be large, numerous, and deep, or few and small, varying with the severity of the case. The sites selected are the face and buttocks, the lesions resembling impetigo or pustular eczema. The syphilitic pustules or crusts are dark, thick, and greenish, forming deeper ulcerations than impetigo, and the itching of eczema is absent. Occasionally a furunculoid eruption occurs, especially in ill-nourished children, the lesions beginning as small nodules in the corium, increasing greatly in size, throwing off irregular sloughs, and leaving unhealthy cavi-

ties and resulting in cicatrices. Bullous and tubercular eruptions are seen occasionally in syphilitic children (pemphigus), the skin showing at first a violaceous patch; soon after vesicles appear, becoming confluent, running together, and growing larger.

The viscera are apt to be more extensively involved in congenital than in acquired syphilis. The lesions are less likely to be gummatous than interstitial, the hyperplasia being more or less diffuse. The interstitial connective tissue in the process of overgrowth and subsequent contraction shrinks the parenchyma. The lung, or a portion of a lobe, may present a profuse fibroid infiltration. The spleen is usually more or less enlarged, and the capsule is thickened. The liver not seldom is enlarged and hardened, from a profuse sclerosis; an interstitial orchitis may affect one or both testicles, producing a hardening and enlargement of the glands. General nephritis is an occasional intercurrence. There are two principal ways in which syphilis affects the bones in early life, usually the long bones—the one producing changes at the junction of the shaft (diaphysis), the other attacking the periosteum. Osteochondritis, a purely syphilitic affection, is an inflammatory process occurring at the juncture of the epiphysis with the diaphysis, checking the normal growth of the bones, and thus producing deformity. Periosteitis is more likely to occur after the child has begun to walk. Syphilitic dactylitis is often seen in young children, the phalanges and the metacarpal and metatarsal bones being enlarged to several times their natural size. These may break down and form abscesses. Craniotabes, a thinning of areas of the cranial bones, is often present, the product rather of malnutrition, whether due to syphilis or rickets; it especially affects the occipital bone, since that one is more commonly pressed upon in normal decubitus. In proportion to the severity of the syphilitic poison is nutrition disturbed; in all cases it is much impaired. In the infant the typical appearance is that of a weazened, pallid old man. Such cases are likely to die. Oftentimes nutritional failure is more gradual, due to specific disturbance in the organs of digestion or mere cachectic feebleness. The blood always suffers more or less anemia; being deficient in red corpuscles, there is also a marked leukocytosis. This anemia is of the utmost gravity and significance, and may alone, and directly, cause death. Two other diseases are mentioned, common to childhood, in which similar lesions of the blood appear, and these are splenic anemia and severe forms of rachitis. In hereditary syphilis and in rachitis as well the deciduous teeth are tardy, appearing in the tenth or twelfth month, or later; they are usually poorly devel-

oped and decay early. There is slight involvement of the nervous system in infantile syphilis, the nerve centers escaping rather remarkably. Apparent paralyses, often accompanied by tenderness of the joints, are occasionally seen, which are more likely to be due to myopathic changes; from whatever cause they arise, they readily succumb to specific treatment, and almost never persist. This syphilitic false palsy is an acute epiphysitis, and may be one of the symptoms or the first one of the disease. The nails are subject to two kinds of syphilitic disturbance—ulcerative, from a pustule appearing on the margin of the nail, which may destroy the matrix, and nutritive, coming on more slowly and involving the phalanx. A general irritability is sometimes observed, but does not differ from that of rickets.

Diagnosis.—The diagnosis of syphilis is not so difficult where the lesions are well marked and characteristic, or if there is a reasonably honest or clear history to be obtained, or if there is an opportunity to study the case with sufficient deliberation. Marks of the disease upon the parents are rarely obtained. A history of causeless abortion in the mother is suggestive, but requires thorough sifting. This is said to occur usually at or about the sixth month of gestation. The appearance of the child before the disease shows itself clearly may tell little, but the most characteristic features are those of impaired nutrition, generally without digestive disturbance, and a loss in the normal appearance of the skin, its normal freshness, acquiring a shriveled look, with pallor and yellowness, like coffee mixed with milk. This is especially seen in the face, though it extends to the rest of the body. A persistent coryza, however slight, should be viewed with suspicion. Mucous patches can generally be found, commonly about the anus, scrotum, umbilicus, in the axilla, mouth, and ears; but in children these may appear over almost any part of the surface. The mucous patches are liable to become the seat of an ulcerative process, especially the mouth and throat.

The following points of distinction between syphilitic and scrofulous lesions of the skin have been given by Dr. P. A. Morrow:

"1. Syphilitic lesions are general in their distribution: they may occur upon any region of the body. Scrofulous lesions are more limited in their localization: they have a special predilection for the neck or regions rich in lymphatic glands.

"2. Syphilitic lesions are ambulatory and changing; they disappear and reappear elsewhere. Scrofulous lesions are fixed and permanent.

"3. The color of syphilitic lesions is reddish-brown, or 'leanham' tint. The color of scrofulous lesions is brighter and more violaceous in hue.

"4. Syphilis is distinct from scrofula in its objective appearance and mode of evolution. In the initial stage the syphilitic neoplasms are firm and hard; the scrofulous infiltrations are softer and more compressible. In the ulcerative stages the differences are more pronounced: the ulcers of syphilis are cleaner cut, regular in contour, with perpendicular, firmly infiltrated border encircled by a pigmented areola. Scrofulous ulcers are irregular, with soft, undermined borders; they are painless, bleed easily, and show slight tendency to spread.

"5. The crusts of syphilis are bulkier, thicker, with a tendency to accumulate in layers, and darker in color; the cicatrices are smooth and remain long surrounded by a pigmented areola. The crusts of scrofula are softer, more adherent; the cicatrices are elevated, irregular, bridled; they retain their violaceous color for a long time.

"6. The course of a syphilitic ulcer, though sluggish and chronic, is much more rapid than that of scrofula.

"7. Absence of pain and local reaction characterize both syphilitic and scrofulous ulcers; they are essentially lesions without sensory symptoms."

In connection with the bony lesions it is important to diagnose between syphilis and tubercular and rachitic affections. The following points in diagnosis between syphilis and tuberculosis of the bones are given by Dr. Morrow:

"1. Syphilis exhibits a marked predilection for the long bones; its habitual localization is in the diaphysis, and almost always at its terminal extremity. Tuberculosis is almost exclusively situated in the epiphysis, rarely affecting the shaft.

"2. In syphilis there is a marked enlargement of the bone by more or less voluminous osseous tumors or hyperostoses, with little or no involvement of the soft parts; and in tuberculosis the tumefaction is due less to increase in the size of the bone than to edematous infiltration of the soft structures.

"3. In syphilis there is little tendency to suppuration and necrosis; in tuberculosis the pyogenic tendency is marked.

"4. In syphilis osteocopic pains with tendency to nocturnal exacerbation are pronounced features; in tuberculosis the pain is dull and heavy, not aggravated at night; sometimes there is entire absence of acute painful symptoms.

"5. The osseous lesions of syphilis rarely react upon the general system, while those of tuberculosis often determine a marked

impairment of the general health, grave complications, hectic fever, cachexia, etc."

In syphilitic dactylitis there is little involvement of the soft parts, the swelling being caused by the enlargement in the size of the bone. In tubercular dactylitis the swelling is due more to an edematous infiltrated condition of the soft tissues than to enlargement of the bone. In the latter cases breaking-down of the tissues and ulceration are more apt to ensue.

The diagnosis between syphilis and rachitic bone-lesions may become of great importance. Epiphyseal swellings occurring under six months are apt to be syphilitic. In syphilis the epiphyseal swelling may be unilateral, but it is always symmetric in rachitis. In doubtful cases the swelling must be subjected to specific treatment. It is well to remember, however, that rickets and syphilis may coexist in the same case. There is almost invariably enlargement at the costochondral articulations in all cases of rickets, which is absent in syphilis.

Prognosis.—Above one-third of fetuses affected with syphilis die before birth, and about the same proportion of those born alive perish inside the first six months. The earlier the symptoms appear after birth, the severer will the type of the disease be and the worse is the prognosis. If the digestion remains good and the food supply is wholesome, as in those provided with good breast milk, the infant may grow up and thrive. The better the circumstances of hygiene and environment, the better the chances for full recovery. A severe coryza interfering with blood aëration exerts a very destructive effect and demands careful treatment.

Late Manifestations. — Children with congenital syphilis sometimes fail to give evidence of the infection, and the ordinary symptoms as seen in infancy escape attention. Later, however, characteristic lesions appear, or the disorders become manifest in certain developmental defects involving the teeth, the bones, the genitalia, and, indeed, are widely extended, but are not always or all to be unreservedly ascribed to syphilis. In those instances, too, where the disease has been recognized and placed under proper treatment and the symptoms have disappeared, the little one fails to develop like other children. Growth is slow and inadequate, and there are facial and cranial characteristics which often render the disease recognizable at a glance. A young man or woman may be neither bigger nor look older than a boy or girl of ten or twelve. The organs of generation particularly suffer, but the other organs are small and inefficient, and the vitality of such sufferers is low. The characteristic face is familiar

to all medical students: the lusterless skin, prominent forehead, asymmetric skull, the depressed bridge of the nose, prominent lips with striated lines running from the corners of the mouth, the peg-shaped central incisor teeth, notched in the middle, the eyelids inflamed at the edges, spotted or hazed with cicatrices on the cornea—this is a picture familiar in all clinics. Evidences of syphilis obtrude themselves at two periods—the time of second dentition and at puberty. The most graphic feature is the peculiarity described by Mr. Hutchinson, affecting the central upper incisor teeth, the significance of which has, however, been unduly exaggerated. This consists in the loss of the central cusp, causing a cupping or "crescenting" of the cutting-edge, and also a narrowing at this edge, the base of the tooth being wider, and the tooth is usually described as "peg-shaped." The cause of this is said to be a defective growth within the alveolus or early infantile stomatitis or alveolar periosteitis. There may also be a change in the shape of the palate, which usually has a very high arch, and ulcerative changes take place here and in the nasopharynx which result in shrinkage and, later, deformity. Large, indolent, mucous patches may occur upon the gums and tongue, continuing out upon the lips and cheeks, especially at the corners of the mouth, leaving long, striated scars. One of the commonest and most important changes is due to a periosteitis involving various long bones, with thickening upon the surface of the bone, inducing changes in its form. These are occasionally unilateral, though usually symmetric and attended with little discomfort aside from occasional nocturnal pains. The nasal bones may be affected to the destruction of the bony arch of the nose, and the result in the well-known flattened bridge deformity. About the time of puberty the eye is liable to a peculiar form of inflammation, an interstitial keratitis, producing opacity of the cornea without much disturbance of the conjunctiva; along with this may coexist an iritis of an indolent kind, yet lacking the severe pain and sensitiveness to light seen in other forms of inflammation of the iris. The corneal opacity may obscure this, as well as other deeper-seated troubles, as choroiditis and retinitis. The ear is subject to inflammatory affections from which rapid deafness sometimes results in spite of all treatment. Visceral disturbances occur, and both the spleen and the liver may become enlarged, alone or together. A number of changes take place in the genital organs; in younger children the testicles are sometimes enlarged, accompanied by hydrocele, and this may involve both the epididymis and the cord and work destructive changes. Frequently the only evidence of syphilis in early years

is mere arrest and perversion of development; the testicles may be very small and inefficient, and in girls the mammary organs fail of development and menstruation is liable to be delayed and inadequate; not seldom such cases develop epilepsy.

Janeway calls attention to an occasional febrile condition due to syphilis, which is readily confounded with acute tuberculosis and may cause death.

Treatment.—In the management of infantile syphilis the possibilities of prophylaxis are large if the parents seek timely advice. As illustrating what can be done, the following instance will be suggestive. One of the authors had under treatment a gentleman with fully developed syphilis which soon became moderately controlled. The mouth presented abundant mucous patches, slowly healing, and in flat defiance of our advice he married a perfectly healthy woman. He followed our advice in other respects, which was to subject his wife, as well as himself, to systematic treatment, and they each took protiodid of mercury in pill form, which was selected for convenience, and continued for at least a year, at about which time a child was born which we kept under observation for between two and three years, without the slightest symptom showing in mother or child. This may have been a perfect result, or developmental defects might have shown themselves later. Had more thorough supervision been allowed, perfect prevention might have resulted.

It must not be lost sight of that the infant may contract syphilis *de novo* from a parent or other source of infection. In the treatment of the syphilitic infant it is necessary to use specific medication, and along with this conscientious attention to nutrition. Mercury in some form is certainly the best remedy. Internally it may be given to the mother, and through her milk the child is more or less affected; for the medication of the child directly mercury is best given by inunction, although in this form it occasionally disagrees; or internally, when it is much more likely to disagree; or both, or alternately. This treatment at times must be omitted for a few weeks, and iron and cod-liver oil and other tonics substituted. The form for inunction may be the mercurial ointment, diluted, if necessary, where the skin is oversensitive, or in its full strength and freely where it is necessary to produce a prompt impression; and, indeed, it is important that no time should be lost in impressing the system with the drug. A 10 per cent. solution of the oleate of mercury, of which five drops are rubbed in three or four times a day, is an excellent and cleanly form. Mercurial ointment one part, and lanolin and cold cream, of each, two parts, is preferred by some. This should

be smeared on a flannel bandage and applied about the abdomen, or rubbed in on the inside of the thighs or axillæ every day, using about a dram each time. Before using the external applications it is important that the skin be thoroughly cleansed with soap and warm water. Internal medication, on the whole, is more accurate and satisfactory, and various forms of mercury are recommended, in some cases the iodids also, but strict care should be taken to keep the mouth perfectly clean or stomatitis will result. The indications and doses depend to a great extent on the locality or organ affected—whether the skin, mucous membrane, lymphatic glands, muscles, blood-vessels, bones, viscera, nervous system, or the sensory organs, and upon the time at which the first symptom was recognized.

Internal medication consists at first of the various mercurial preparations, and later of iodids and tonics—hematics and reconstructives. Osler, quoting from Hutchinson, uses the gray powder,—mercury with chalk,—from $\frac{1}{15}$ to $\frac{1}{2}$ of a grain, four to six times a day, guarded, if necessary, by a small quantity of Dover's powder. We have seen these results of Osler's, know them to be brilliant, and prefer the same remedy. Jacobi recommends small and frequent doses of calomel, $\frac{1}{20}$ to $\frac{1}{6}$ of a grain three times a day, for months in succession. If diarrhea occurs, he adds to each dose $\frac{1}{20}$ to $\frac{1}{12}$ of a grain of Dover's powder. Bichlorid of mercury is advocated by many. Van Swieten's liquid has enjoyed a large reputation and still has many advocates. This consists of bichlorid of mercury, 1 part; water, 950 parts; rectified spirits, 100 parts; five to twenty drops in milk three times a day. Baths of mercuric chlorid are also useful, the child being placed in the following bath for fifteen minutes: Mercuric chlorid, 4 grains; ammonium muriate, 6 grains; water, 2500 grains, or bichlorid of mercury may be given in various combinations, from $\frac{1}{200}$ to $\frac{1}{60}$ of a grain twice or thrice daily. A good menstruum for this, especially if intestinal irritation ensues, is elixir of pepsin or elixir of bismuth. The mercurial treatment should be continued for about one year; longer if symptoms persist. The doses should be gradually lessened after six months. The treatment is similar for those cases of infants and children who have acquired syphilis; this may come about (Jacobi) by the ritual sucking-out of the circumcised prepuce, the syphilitic nipples of a mother or nurse, kissing, the use of infected instruments, and, in older children, sexual contact. The acquired form of syphilis in infancy and childhood is apt to run a swifter and more deleterious course than in adults. When it becomes necessary to check the ravages of syphilis at once, mercury

should be given subcutaneously; and here calomel is not so well borne in children as the bichlorid of mercury, one to two grains in an ounce of distilled water, from $\frac{1}{100}$ to $\frac{1}{50}$ of a grain twice daily. When the bones and glands suffer, it is well to add to the mercury potassium iodid, two to five grains four times a day, in milk or alkaline waters. Children bear the iodids in full doses remarkably well. Under all circumstances the treatment must be persisted in for many months after the disappearance of the symptoms.

The constitutional disorder may break out in one of many ways, producing osteitis, a caries or sclerosis of nerve tissues affecting the brain or spinal cord, or a meningeal exudation. Gibert's syrup consists of the biniodid of mercury, 3 grains; potassium iodid, 200 grains; water, 3 ounces, and syrup enough to make 10 ounces. Dose for a child under three years, five to ten drops, gradually increased. The use of mercurial fumigation is advocated by some. The local treatment of mucous patches, excoriations, and especially of the coryza is very important. The nose should be kept clean by a wash, such as Dobell's solution or boric acid in solution; so, also, to the mucous patches, and other surface lesions. Mild specific medication is demanded, such as black wash. A 2 per cent. solution of Squibb's oleate of mercury is useful applied to the nose, or fifteen grains of calomel to one ounce of liquid petroleum applied to the nose or to condylomata, or these last may be dusted with calomel alone or with calomel and boric acid. Nitrate of silver is of value for indolent lesions and mucous patches in the mouth or on the genitalia. Sluggish symptoms, such as lymphadenitis or pulmonary infiltrations, where there is reason to suspect syphilis, will often yield most promptly to mercurial treatment, even though it is not certain that these arise from syphilis any more than from scrofula or tuberculosis. It must be borne in mind that mercury, as well as the iodids, has a tonic effect upon syphilitic individuals, and may be continued along with other tonics, of which iron is the chief.

A very large measure of attention must be given to the general health of children suffering from syphilis, who are peculiarly feeble and deficient in resistance. This subject is elaborated in the chapter dealing with the subject of development.

Syphilitic ulcers should be cleansed, then cauterized by silver nitrate, and covered with mercurial plaster. For stubborn syphilitic affections Ullmann recommends electric mercuric chlorid baths. The baths should continue from thirty to forty minutes, the electric current to be passed through the bath from 100 to

200 ma. The addition of ten grains of calomel to ten gallons of water is a useful measure. Thyroid extract has been highly recommended. Menzies reports four cases of malignant syphilis which he treated by thyroid extract, no other remedy being used. He noticed an improvement in all the cases. From this he concludes that the remedy is a powerful skin tonic and a useful adjuvant to mercury and potassium iodid in the treatment of syphilis.

Türbinger has called attention to the fact that during mercurial treatment syphilitic patients occasionally develop nephritis. Out of 100 cases, eight had developed albuminuria in consequence of the absorption of mercury. Some believe that nephritis is due to the use of insoluble preparations of mercury; the treatment in these cases is to be discontinued, and during a long mercurial course examination of urine is not to be lost sight of. All sufferers from syphilis require watchfulness for years, and the use of carefully selected food, tonic, and nutritive stimulants.

MEASLES.

Synonyms.—RUBEOLA; MORBILLI.

Measles is an acute infectious and highly contagious disease, characterized by fever and nasobronchial catarrh and by the appearance of a distinctive maculopapular eruption on the face and on portions of the body. It occurs in wide-spread epidemics of variable virulence and extent, recurring every two years or eighteen months. Its spread is so rapid and universal that during an epidemic few of the youthful members of a community escape. It is especially noteworthy that in communities which have been free of epidemics for a long period the course of the disease is marked by great fatality; for instance, the savages of New Hebrides were decimated in a remarkably short time by an epidemic of measles originating in a mild case of an English sailor on board a trading vessel. In civilized regions, however, where the disease is frequent, the mortality is relatively small, practically nothing among the children of the well-to-do, whereas the poorer and badly nourished children of lower classes suffer more seriously. Age seems to prescribe no limit to an attack, infants occasionally being born with a distinctly visible rash.

The febrile incubation may be as long as fourteen, even twenty-two, days, ten being perhaps the average, the invasion of three to five days presenting symptoms of an acute coryza. Measles is most highly contagious, and it is said the disease may be "taken"

from another at any time after the moment of the inception of the infection. The contagium, however, does not cling to objects so tenaciously nor so long as does that of scarlatina; indeed, after desquamation and possibly before the end of it the virulence ceases.

Causes.—Measles is due to a specific micro-organism in all probability, but it has not yet been isolated. Whatever the contagium is, it is most active and more readily attacks those unprotected by previous infection than the poison of scarlatina, but is not so tenacious nor so long lived.

The medium of contagium is presumably the nasal and bronchial discharges, the breath, and the tears. It is communicable by mediate contagium and by the air.

Though a disease distinctly of childhood, yet it often attacks adults and produces grave conditions and complications, even when the individual has already had or is supposed to have had the disease. Repeated attacks of measles do occur, but this is doubted by competent observers. Many other conditions strongly resemble measles, notably the rashes of influenza and rubella. Children at the breast seldom contract the disease, or if so, it affects them very mildly.

Symptoms.*—The first manifestations of the attack are a marked coryza and a hard, dry, and sometimes croupy cough. This cough may exist for a week or more before other symptoms show. A whole day or more before the appearance of the eruption the fauces may be seen to be greatly reddened and injected and covered with a distinct rash. This papular eruption of the fauces is observed in many other infections. Koplik draws attention to certain bluish-white "pearly" spots situated on a red base, seen on the mucous membrane of the lips and cheeks, about on a line with the teeth. These are observed as early as seventy-two hours before the appearance of the eruption. † The tongue

* An early sign of measles is recorded by Muenier ("Jour. de Med.," Jan. 25, 1898), which may at times prove to be of practical value, viz.—a loss of weight before any morbid symptoms occur; it is noticeable on the third day of incubation and becomes more marked until the pyrexia and coryza appear; hence it is a sign of the precontagious stage, and is independent of the age of the patient or the severity of the attack. This might lead to early isolation and check the spread of the malady.

† To quote the words of Henry Koplik: "This sign is only of value as it appears on the buccal mucous membrane (the inner surface of the cheeks and lips). Any signs, spots, or appearances on the hard and soft palate, the pillars of the fauces, the conjunctiva, are of no value and rather misleading, for signs and spots exactly similar to those described on the hard and soft palate and pillars of the fauces appear not only in measles, but also in Rötheln, scarlatina, and grip, and simple sore throat. The buccal spots, as described by me, appear only in measles, and in none of the exanthemata, and to my positive knowledge in no other known disease of the mouth or

is coated a dusky "raspberry" red, and though supposed to be distinctive, this can not be relied on. Accompanying the coryza are great drowsiness, headache, redness and watering of the eyes, sharp injection of the conjunctiva, and usually a cough. The throat is often sore, with moderate congestion of the tonsils, fauces, and larynx. The temperature rises in the evening and falls in the morning. After about four days of these prodromal symptoms the characteristic eruption becomes manifested. It occurs first back of the ears, at the roots of the hair, but rapidly spreads over the face and neck, which is the principal seat of the eruption. It is usually discrete, but may become confluent in severe cases. A bran-like desquamation follows. The rash is so characteristic that in conjunction with the coryza, cough, and injection of the cornea a diagnosis of measles should not be difficult, although error is permissible in view of the variations which always occur in the eruptive and general symptoms of a specific fever. The erythema consists of groups of dusky red, "crimson" papules surrounded by discs of a brighter red, which offer strong contrast to the intervening spaces of normal skin. The papules are hard, though not so "shot-like" as to become confused in ordinary cases with the papule of variola. Frequently the papular areas combine to form a crescent, and this crescentic appearance of the group offers a differential point between the rash of measles and scarlatina. Moreover, the papule of scarlatina is brighter red, smaller, petechial, and is not often raised above the surface. In some serious cases the rash becomes hemorrhagic,—"black measles,"—an evil sign, indicating that hemorrhages may occur in the vital tissues. The maximum temperature is usually coincident with the greatest profusion of the rash. During the stage of eruption the temperature gradually falls to normal. If after the fourth or fifth day from the beginning of the eruption the pyrexia still persists, some complication, most commonly bronchopneumónia, should be suspected.

Like all the other exanthemata, measles is apt to vary in respect both to the virulence and character of its general manifestations. The typical case is marked by a higher or lower degree of pyrexia, by its own peculiar eruption, and by a catarrhal affection of the respiratory tract. Sometimes one or another of these

---

any constitutional affection. They must be looked for in a very strong daylight. They must be seen in the discrete state—that is, small, irregular, rose-colored spots, with a very minute bluish-white speck, just large enough to be visible in the center of the rose area. Patches or yellowish specks must be excluded. We study the buccal membrane by everting it toward the light with the finger or a depressor. We observe the inner surface of the lips also."

symptoms may be greatly exaggerated, or, on the other hand, almost totally absent. In the milder cases the eruptions may be quite obscure and the catarrhal phenomena slight, while in the more malignant forms the eruption is darker, more "angry," and the coryza may develop into a severe form of bronchopneumonia which calls for vigorous treatment on its own account. In these severer cases the eruption is apt to be dilatory in its progress, "suppressed" or "struck in," and makes its appearance at irregular intervals and on various parts of the body. Frequently the child has been manifestly ill for several days with bronchopneumonia, and then the rash appears on the buttocks, for instance, which are so often the seat of various eruptions in childhood, thus greatly embarrassing a clear diagnosis of measles.

The more serious of the sequelæ of measles arise out of the nasobronchial catarrh and the consequent inflammation of the respiratory passages. As already stated, the bronchopneumonia is the most frequent and indeed the most dangerous complication; membranous laryngitis also not rarely occurs. During the progress of these complications the glands in the neighborhood of the lesion, especially the small mediastinal glands, are apt to become overloaded with the effluvia of inflammation; swelling and induration result, and there gradually sets in a caseous degeneration of the gland. In unhealthy scrofulous children this condition often leads to cold abscesses, scrofulous ulcers, and many of the forms of lung disease, notably miliary tuberculosis. Other complications are diarrhea and marasmus. The former is more of the nature of acute dysentery, while the latter has been recorded as occurring in a number of cases of infants and very young children. When the pyrexia continues, the eruption is fitful, and there is at times a condition of ulcerative stomatitis. It may be said, as a general rule, that measles does not recur after the first attack, but there is no doubt that a relapse may take place, and there may indeed be, though some doubt this, a second genuine infection after a period of one or more years.

Pathology.—Investigation has thus far thrown but little light on the morbid anatomy of measles. In the urine and also in the blood-serum and leukocytes micrococci have been found—a fact that argues the need of further researches as to the etiology of the disease.

Diagnosis.—Being of slow onset and almost uniformly preceded by symptoms of marked disturbance of the respiratory tract, there should be little difficulty in differentiating between measles and scarlatina, the latter being of sudden onset and presenting the rash after the short period of twenty-four hours. To

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

THE PATHOGNOMONIC SIGN OF MEASLES (KOPLIK'S SPOTS).

FIG. 1.—The discrete measles spots on the buccal or labial mucous membrane, showing the isolated rose-red spot, with the minute bluish-white centre, on the normally colored mucous membrane.

FIG. 2.—Shows the partially diffuse eruption on the mucous membrane of the cheeks and lips; patches of pale pink interspersed among rose-red patches, the latter showing numerous pale bluish-white spots.

FIG. 3.—The appearance of the buccal or labial mucous membrane when the measles spots completely coalesce and give a diffuse redness, with the myriads of bluish-white specks. The exanthema on the skin is at this time generally fully developed.

FIG. 4.—Aphthous stomatitis apt to be mistaken for measles spots. Mucous membrane normal in hue. Minute *yellow points* are surrounded by a red area. Always discrete.

—(*From "Medical News."*)

differentiate by means of the rash is often rather difficult; in typical cases of the two diseases there should be no confusion, but, as previously intimated, the form and nature of the erythema in infectious fevers vary greatly. The spots of Koplik are a very constant and characteristic phenomenon.

Complications and Sequelæ.—Complications are rare in patients over four years of age. The commonest is broncho-pneumonia, and next come intestinal derangements. Mild catarrhal laryngitis accompanies most cases, membranous laryngitis not so rarely. A well-marked pneumonia is found in nearly every fatal case. In certain epidemics pleurisy is a frequent accompaniment. A true diphtheria may accompany and is a deadly complication.

The heart is occasionally attacked, rarely, it is said, but we have seen some notable instances of severe involvement. Measles may be complicated by almost any other of the infectious diseases, one developing as the other subsides.

Treatment.—Prophylaxis is of far greater importance and feasibility than the laity is inclined to think. Upon the first symptom of measles the patient must be put to bed and screened from the light, remaining there until all traces of the eruption have disappeared, which is usually at the end of a week or ten days, and the child should remain in the same room until the end of the fourteenth day, at least. Another week should be spent indoors, and at the end of the third week, weather permitting, an outing may be cautiously allowed. The temperature of the sick-room should be 68° or 70° F., a little warmer than for scarlatina. The bed occupied should have a mattress of hair and be surrounded by a screen; the coverings should be light and only moderately warm. The air of the room should be kept constantly fresh and moist. Drafts can be avoided by placing a cheese-cloth screen immediately in front of an open window. While the photophobia lasts the room should be moderately darkened and the patient's face turned away from the source of light. Mild cases require only general hygienic measures suitable for any febrile disease, with strictly regulated diet as to amount and hours of feeding. The tendency is for catarrhal states of the digestive organs to coexist or follow, especially aggravated by coarse articles of diet, overfeeding, or the use of laxatives. The quantity of food should be reduced to that suitable for a younger child, and it may be fed a little oftener than in health, the food being altogether fluid. Milk, the chief item, should be more than ordinarily guarded by alkalies and diluents, to prevent the formation of tough coagula. If gastric irritation sets in, meat-

juices, soups, and egg-water should be substituted in small amount and at shortened intervals. Plenty of water is to be allowed, but not in too large drafts at once, preferably administered in a small vessel holding only an ounce or two. It is well at the beginning to secure a cleansing of the bowels, and a simple laxative, such as castor oil or calomel, may be used with caution, but an enema is usually sufficient, because of the tendency to diarrhea. It is well, also, to make sure of skin activity at the outset by giving warm baths, repeated once or twice a day, until the eruption shows itself abundantly on the surface. Throughout the course of the disease it is especially important to watch and treat the catarrhal tendency, which involves the digestive tract, as has been said, the respiratory organs, the eyes, and the ears.

If the eruption is distinctly delayed or retrocedes, some complication is to be feared, and the skin demands stimulation by local applications, such as heat to the chest, abdomen, and, above all, to the feet and legs, which last may be sufficient. If the difficulty is very marked and inflammation of the internal organs is feared, hot baths or packs and stimulants are required. At the height of the eruption the temperature may rise to 105° F. (40.5° C.) without aggravating the other symptoms or signifying anything serious, unless unduly protracted, when cool baths should be employed at 90° or 95° F. every three hours and for half an hour. If the cool bathing seems to prostrate, it is well to follow it promptly by alcoholic stimulants and external heat. Quinin is the safest antipyretic, preferably given by suppository, two to four grains every four hours for a child of ten; one-fourth of a grain for a child of two. Few medicines are required: For the fever, solution of ammonium acetate, or, if the cough is troublesome, solution of potassium citrate, every two or three hours, to which may be added syrup of ipecac, five or ten drops, or ten or twenty drops of paregoric, or both. If the bronchial catarrh is moderate, it may be let alone; if severe, or if bronchopneumonia sets in, the treatment should be prompt and efficient—carefully applied counterirritation, cold to the chest, and stimulating expectorants, as described elsewhere. (See Bronchopneumonia and Pleurisy.) Oxygen may be necessary if the pulse grows feeble or cyanosis becomes marked, along with cardiac stimulants, among which iodid of potassium must not be forgotten. For the eyes a cleansing wash, such as boric acid, fifteen grains to the ounce, to which may be added, in extreme photophobia, half a grain of cocain. The nares and pharynx, if markedly catarrhal, may be cleansed by the same means, and subsequently applications made of

glycerol of tannin or acetate of zinc. Great care must be exercised during convalescence: the heart and kidneys must be watched and attention given to conditions of bronchial and other catarrhs. Skin-cleansing should be careful and thorough, and during the process of desquamation soothing ointments are of value, of which boric acid ointment is among the best. If the itching is great, to this carbolic acid or resorcin may be added, but carbolic acid is not altogether safe, especially over very large surfaces. Malignant measles requires powerful stimulation and abundant tonics, especially quinin, digitalis, carbonate of ammonium, and mustard baths, along with brandy or hot coffee.

RUBELLA.

Synonyms.—GERMAN MEASLES; RÖTHELN.

Rubella is a very mild member of the group of infectious fevers, characterized by a slight rash and a condition of general malaise lasting for a few hours or two or three days. So far as external appearances go, the disease would seem to be of a somewhat variable character, possessing points of similarity to both measles and scarlet fever. It is, however, a separate entity, as an attack of rubella does not protect either from measles or scarlet fever, although it generally occurs but once in a lifetime, nor does an attack of either measles or scarlet fever confer immunity against rubella.

Causes.—The origin of rubella is no doubt bacterial, and there are those who seek to account for its frequent resemblance to measles and scarlatina by holding that its cause is a hybrid product of the infectious principles of these two more malignant affections. There may, indeed, be some truth in this, though it lacks scientific confirmation.

The two generally recognized forms of rubella—namely, rubella morbillosa and rubella scarlatinosa—are supposed to be variations from the typical disease, in that the epidemic is influenced in its phenomena by the coincident existence of an epidemic of scarlet fever or of measles, the rubella taking on some of the characteristics of whichever one may be prevalent at the time. The disease occurs usually in epidemics, although sporadic cases may be found. It is of somewhat rare occurrence, does not always admit of unquestioned diagnosis, and demands great attention, owing to its unfortunate resemblance to the two more serious diseases before mentioned. Rubeola and rubella bear practically the same apparent relation to each other that exists

between variola and varicella. Much harm results from a hasty dismissal of alarm by pronouncing an ailing child a case of "merely German measles," while in reality the child is suffering from measles or scarlet fever, very serious diseases and accompanied by damaging complications and sequelæ. Adults seem at times almost as prone to attacks of rubella as are children, although the symptoms are more marked in the latter. One attack engenders a degree of immunity, but an evidence to its own right to a place among the specific diseases is shown, as has been before stated, in the fact that it grants no immunity with respect either to measles or scarlatina, nor, on the other hand, do these afford security against a subsequent attack of rubella (Griffith). In a doubtful case strict isolation should be promptly enforced.

Incubation.—The period of incubation is variously estimated at from one to three weeks. There is some uncertainty as to this, but the average time may safely be stated to be about two weeks.

Symptoms.—There are generally few or no premonitory symptoms. Occasionally, however, the patient complains of slight headache, pain in the back, sore throat, and coryza, and in some cases there are nausea and vomiting. Very frequently the appearance of the rash is the first symptom noticed. There is often swelling of the cervical glands along the posterior margin of the sternomastoid muscle. The rash is usually a rosier red than that of measles, and the papules are ill defined. There may be simply a rosy blush; the confluence of papules and erythema may give rise to a suspicion of scarlatina, but the rubella rash is not so clearly punctiform as that of scarlet fever. The amount of fever is usually small—indeed, the attack is almost devoid of any rise of temperature. In the majority of cases, however, a rise of from 99° to 100° F. (37.2° to 37.7° C.) is noticed, very rarely to 101° or 102° F. (38.3° to 38.8° C.). The temperature returns to the normal as soon as the rash disappears. Some hyperemia of the conjunctiva and fauces is frequently noticed, but is neither so common, prolonged, nor severe as in measles. The most distinctive feature is the affection of the lymphatic glands, which show a wide-spread, almost universal enlargement, quite different from the more localized adenopathies of scarlatina or diphtheria. Measles shows relatively little; in scarlatina the glands and interglandular tissue below the jaws are the parts more commonly affected.

The **prognosis** is most favorable. Quarantine should be observed for at least three weeks. Complications are rarely seen and in very severe cases only.

Diagnosis.—In epidemics there should not be so much difficulty in establishing a correct diagnosis. In isolated cases mistakes are liable to occur, and rubella may be mistaken for any of the erythematous affections so common to childhood. The rash varies so widely in appearance that this alone can not be relied upon as a guide. Inasmuch as there is no positive characteristic symptom of rubella, there is often much confusion in properly differentiating rubella from measles. The rash of measles appears after the fourth day of prodromal symptoms, while in rubella there are practically no prodromes. The presence of Koplik's spots will aid in the decision materially, as they are not found in rubella. In scarlet fever the rash is usually preceded by malaise, vomiting, and sore throat. The temperature can always be taken as an important indicator in determining diagnosis. In rubella it is not uncommon for the patient to maintain a normal temperature, or, at the most, to suffer only a slight febrile rise. As an aid to the differential diagnosis of the various infectious diseases we give the following table, which has been taken from the admirable text-book of Rotch:

	Variola.	Varicella.	Scarlet Fever.	Measles.	Rubella.
Incubation, . .	Twelve days.	Seventeen days.	Four days.	Ten days.	Twenty-one days.
Prodromata, .	Three days.	A few hours.	Two days.	Three days.	A few hours.
Efflorescence, .	Macules. Papules. Vesicles. Pustules.	Vesicles.	Erythema.	Papules.	Papules.
Desquamation,	Large crusts.	Small crusts.	Lamellar.	Furfuraceous.	
Complications and sequelæ,	Larynx. Lungs.		Kidney. Ear. Heart.	Eye. Lung. Tuberculosis.	

Treatment.—Rubella requires no particular treatment and possibly no medication, but it should always be borne in mind that an exanthem may not be ignored, and care must be exercised lest some accidental exposure or state of exhaustion reacts unfavorably upon the blood or the vital organs. We have seen many cases of this disease, and some of them caused much concern. During the stage of eruption the bed is the only safe place, or at least a uniform atmosphere in one room. The diet should be exceedingly simple, and large quantities of water

should be drunk; the skin should be properly protected, at least until desquamation is completed. There is generally an uncomfortable feeling in the throat, which should be relieved by the antiseptic alkaline spray through the nostrils, followed by vaporized petroleum, to which some aromatic may be added, as camphor or menthol. Conjunctival irritation is sometimes present, when an antiseptic wash may be needed, as boric acid, fifteen grains to one ounce of distilled water, and if there is pain, a small amount, as from one-half to one grain, of cocain may be added. The bowels should be kept open.

THE BUBONIC PLAGUE.

Synonym.—MALIGNANT POLYADENITIS.

This disease has received various names at different times. In 1856 it was known in Tripoli as "typhus with glandular swelling"; in the same year, in Chios, it was called "petechial typhus." In Mesopotamia, where the disease was prevalent from 1856 to 1885, and is possibly so at the present day, it received the titles "adynamic typhoid fever" and "intermittent fever with glandular swellings." In Persia, where the plague seems to be endemic since 1856, it is known as "hemorrhagic fever." During the years 1877 to 1889 Astrakhan, a Russian province, was visited by this disease, which was described as "intermittent fever with buboes," "croupous pneumonia with buboes," "typhus with glandular swellings, proving fatal with pneumonia," and a "peculiar form of mumps."

Plague, or malignant polyadenitis, may be defined as an acute febrile disease of an intensely fatal nature, characterized by inflammation of the lymphatic glands, marked cerebral and vascular disturbances, and by the presence of a specific bacillus. At the present day the plague is confined to Asia, but since 1850 it has appeared in Europe, Asia, and Africa. The Mediterranean basin and the strip of country running parallel to that sea across the Continent of Asia, from Turkey to China, may be taken as its present habitat during the nineteenth century. It may prevail in any climate and latitude, and in any season of the year. Moderate temperatures combined with dampness favor its propagation. The prodromata of the affection may appear before an outbreak, during a period varying from a few weeks to several years, as buboes with fever, and in a more or less epidemic form. This disease is readily inoculable, and is undoubtedly contagious, but the intensity of its virulence is greatly modified by free ventila-

tion and attention to hygienic rules. The channels by which the plague may be acquired are the alimentary canal, the respiratory tract, and the skin. The localities in which the disease seems to be endemic may be accounted for by the fact that they have been subjected to a miasmatic infection, along with conditions of poverty, overcrowding, and neglect of the common hygienic precautions.

Among the lower animals, the rat seems most liable to be attacked. Rats thus suffering from or dead of the plague may infect other animals that consume them, and, in addition, rats are always affected by a disease similar to the plague at the same time that man suffers.

The disease is commonly fatal in children, but not in nurslings, many of whom survive their mothers. In children the adenitis is usually most pronounced about the cervical and nuchal region, by extension from lesions in and about the mouth. In children, too, there are cases with no recognizable buboes, especially in the later stage of an epidemic; it is rare in the earlier weeks of its prevalence (Dr. Arnold, U. S. N.).

Causes.—On the fourteenth of June, 1894, Kitasato and Yersin, working at the time of the epidemic at Hong Kong, demonstrated the specific bacillus of bubonic plague. It is described as a diplococcus inclosed in a delicate capsule, and a short bacillus with rounded ends and a clear space or band in the center.

An interesting fact, demonstrated by some figures drawn by Woodhead, is an apparent development of the bacillus after death, similar to the development of the flagella of the plasmodium malariæ some half an hour after removal from the body. There has been nothing definite determined respecting the influence of heat or cold, dryness or moisture, upon the development of the plague; but poverty, overcrowding, and bad sanitation are potent factors in its causation.

Notwithstanding the terrible mortality attending the plague, which has been placed as high as from 90 to 95 per cent. of those attacked, the disease is not so infectious as scarlet fever, measles, smallpox, or typhus. Four types of the disease are recognized: (1) Bubonic or ganglionic; (2) septicemic; (3) pneumonic; (4) intestinal (rare).

Symptoms.—In the bubonic variety the onset is usually sudden and severe. The first symptom is a chill, followed by a temperature more or less high, and in some cases reaching 106° or 108° F. (41.1° to 42.1° C.). Nausea, vomiting, headache, and extreme prostration are marked symptoms. A glandular

enlargement, usually in the axilla or groin, rapidly supervenes, forming a bubo surrounded by an extreme edema, and giving the character from which this variety of the disease takes its name.

The skin is hot and dry, the countenance is dusky, the eyes are sunken, and the features are drawn. There may be excitement or apathy. The temperature may rise suddenly to 104° F. (40° C.) or more, or it may reach its maximum only after two or three days. In 76 per cent. of cases the superficial lymph-glands are enlarged and tender. As a rule, one group of glands alone is affected, and it may be but one gland in a group which shows signs of adenitis. Ninety per cent. of the buboes suppurate. The bowels are irregular, and the dejecta sometimes contains blood. The spleen is always, and the liver is usually, enlarged. There may be bronchial catarrh or pneumonia of a septic type. The renal symptoms vary. During the first epidemic albumin is rarely present in the urine, while during a recurrence it is found in 95 per cent. of cases. The nervous symptoms vary from delirium to coma. Death may occur in twenty-four hours, but the third or fourth day is the fatal period. The death-rate among the Chinese and natives of India is 90 per cent. and over; among Europeans it is 50 per cent. The symptoms of plague are so misleading that it is impossible to form a prognosis.

The **diagnosis** is most difficult, and may only be possible with the aid of the microscope and bacteriologic investigation.

When the bubo suppurates and breaks down, as it usually does, the disease passes into the septicemic form. This form of the disease can also be produced by infection through the intestinal, digestive, or respiratory passages.

The pneumonic form is the most fatal of all the varieties of the plague. It comes on insidiously, the usual premonitory symptom being pain in the side, followed by difficult and embarrassed respiration, cough, and the expectoration of a bloody, tenacious mucus which, under the microscope, is found to contain the bacillus pestis in great profusion.

Treatment.—The most successful treatment is by the use of the antitoxic serum perfected by Yersin. This, if used early, will forestall the heart failure so common, and the buboes soften and disappear without suppurating. The use of this serum is disappointing in the Orient, but in Oporto it has, according to Calmette, reduced the mortality to almost none.

The moment plague breaks out in a dwelling the patient should be removed to an especially constructed hospital. Per-

sons who have been in active contact with the infected and all persons in the dwelling and houses adjacent should be removed to special camps, and be detained there for at least seven days, and subject to medical inspection once or twice daily. Should any of the "contacts," as the exposed persons are termed, develop plague, the building or tent must be evacuated, disinfected, or destroyed. They should be inoculated by Haffkine's prophylactic, and if so, they are exempt from plague rules for a period of six months.

Should the bubonic plague visit our shores, we have little to fear from it. In bygone epidemics, when it destroyed its victims by thousands and even millions, it found a congenial soil in the filth and squalor of the middle ages or the barbaric habits of the homes of the far East. Our greatest safety lies in the sanitation of our cities; and in the event of an outbreak, we have a second line of defense in the application of that brilliant discovery of modern science—serum therapy.

GLANDULAR FEVER.

A disorder called "glandular fever," occasionally epidemic, has been described by several writers, especially by E. Pfeiffer, in 1889, O. Huebner, and others since. These views have been criticized, and no mention is made of this disorder in many recent text-books (1900), but, on the whole, the testimony is fair that a special disease of distinct individuality exists, characterized by fever and swelling of the lymph-nodes. The disease is usually unilateral at first; later symmetric. The lymph-nodes are hard and extremely tender. There is little or no edema of the adjoining tissues nor does suppuration occur. Nephritis occasionally follows, from which prompt recovery is the rule. The cause is not known, but contagion is suspected, not proved. In diagnosis there must be excluded such causes as the commoner infections of mucous surfaces and sympathetic glandular irritations.

CARE AND TREATMENT OF THE HAIR IN ACUTE INFECTIOUS DISEASES.

If, in the acute infectious diseases of childhood, the hair should become thinned or fall out almost entirely, it will always be replaced again; therefore on that score there need be no worriment. Frequently the patient is so ill or so delirious, neuralgia

or headaches are severe, or perhaps the ice-cap may need to be applied; it is then better to cut the hair off completely, so that the patient may be disturbed or irritated as little as possible or remedies be properly applied. With boys and young girls the hair had better be cut short early; but with older girls with a fine head of hair the tresses need not be sacrificed. The hair should be plaited carefully and the ends secured safely, so that the tresses shall not become tangled or matted, and it need not be disturbed for days. Should the hair become thickly matted and even glued down with dried exudate, it need not even then be cut. Soften the masses with borated oil, and with perseverance and gentle rubbing at very little discomfort to the patient the tangled mass can be entirely combed out. Soap and hot water will in due time remove the oil.

In pustular eczema, impetigo contagiosa, or pediculosis of the scalp the hair should not be sacrificed, although the condition presented would seem to demand so radical but hasty a measure.

After convalescence, should there be falling of the hair due to malnutrition, anemia, or seborrhea, stimulate the sebaceous glands and the hair follicles with precipitated sulphur one dram, vaselin one ounce; or, if a lotion is desired, resorcin twenty grains, alcohol or water one fluidounce; or use the German superfatty soaps. (See treatment of Seborrhea.)

CHAPTER XVI.

DISEASES OF THE SKIN.

APHTHOUS VULVITIS OF CHILDREN.

Aphthous vulvitis is a disorder peculiar to children, and which may occur in the course of such systemic affections as roseola; it has appeared as an epidemic. It begins with the appearance of twelve or fifteen small vesicles, whitish or yellowish gray, confined to the neighborhood of the vulva. These may coalesce in a day or two into patches, and break down into shallow ulcers; the surrounding tissues are inflamed and swollen, accompanied by itching. If promptly treated, it soon gets well.

Aphthous vulvitis may occur simultaneously with aphthous stomatitis in the same individual, and may be confounded with variola, varicella, or localized diphtheria, and it especially resembles herpes of the vulva.

The treatment consists of asepsis and the local use of some antiseptic or astringent powder, as iodoform, aristol, boric acid, or acetanilid, added to a dusting-powder, as talc or starch.

DERMATITIS.

Dermatitis, or inflammation of the skin, may be due to the action of local influences, such as heat, cold, caustics, and other mechanical and chemic irritants which directly exert their effect on the skin, and those which act indirectly, arising from within or taken internally, many are due to the ingestion of certain drugs and also to toxins.

Dermatitis Traumatica.—Under this head are included all those forms of inflammation of the skin due to traumatism, viz.: contusions, abrasions, or excoriations arising from direct violence to the skin—as, for example, especially in children, ill-fitting garments, shoes, bandages, and other articles of wearing apparel. Excoriations from scratching, due to the presence of the various animal parasites, are important varieties. Other accidental lesions are so well known as not to need detailed description.

Treatment.—Remove the cause, and, if necessary, apply soothing lotions or ointments. (See Acute Eczema.)

Dermatitis Calorica.—Extremes of heat and cold both produce analogous inflammatory symptoms, the former as burns and the latter as frost-bites. Erythema solare, or sunburn, is a well-known example of what natural heat can produce. Although this may be erythematous, vesicular, or bullous, it never goes on to complete tissue destruction, as may happen from the ordinary burns or scalds. Cold or frost-bite may produce death of the affected parts from prolonged interference with peripheral circulation.

Treatment.—In burns of a mild degree a saturated solution of boric acid or calamin lotion (for formula see Erythema) should be applied frequently on lint and the parts be kept well moistened; or boric acid one dram and petrolatum one ounce may be used.

Frost-bite.—If seen immediately after exposure, bring parts gradually back to normal temperature by gentle friction by rubbing with snow or cold water. We have seen two cases in which children were told to plunge their feet while excessively cold in warm water result in an angioneurotic edema.

Treatment.—After the parts are restored to their normal temperature, stimulation is called for—applying a 12.5 to 25 per cent. ichthyol ointment in petrolatum or strongly carbolized ointments. Use warm woolen stockings, avoid the girdle garter, and also avoid approaching a fire too soon, which causes tingling and burning sensations. The fluid preparations of diastase are very soothing to subacute conditions.

Dermatitis Venenata.—This heading includes all inflammations caused by numerous external irritants which act deleteriously on the skin. The commonest causes are the well-known irritants,—mustard, turpentine, cantharides, mezereon, arnica,—anilin and corallin dyes (from undergarments and stockings), mercurial ointments, poisonous insects and fish—Portuguese men-of-war, etc. But the most common causes are the rhus plants —poison-ivy (or poison oak) and poison sumac (or poison dogwood). The susceptibility to this poison in individuals varies to a great extent; some can handle the plants with impunity, while in other cases mere proximity is sufficient to cause cutaneous disturbance (toxicodendric acid, Maisch). The lesions produced on the skin are erythema, wheals, papules, vesicles, pustules, or bullæ, with or without edema and swelling. The effect produced depends on the susceptibility of the individual, the virulence of the poison, and the length of exposure, or a combination of any

or all. The symptoms of poisoning by rhus toxicodendron (poison-ivy or oak or poison sumac or dogwood) appear soon after exposure. As a rule, the poison acts quickly, a few hours often being sufficient to provoke an attack; in other cases several days are required. The vesicles vary in size from that of a pinpoint to that of a split pea, and are seated on inflamed and usually inflammatory bases. These vesicles are frequently angular (eczema vesicles are always round), and at times are arranged in streaks or lines. They may coalesce into blebs and become seropurulent or pustular. Marked itching and burning are, as a rule, present. The hands, face, and forearms (in the male the genitalia also) are the favorite parts involved. The disease runs an acute course; the vesicles burst spontaneously or are broken, the contents drying into yellow crusts. The process may continue for from one to six weeks and terminate in complete recovery; or, in those inclined to eczema, it may, however, result in a persistent form of that disease.

Treatment.—Remove the cause and apply soothing lotions and ointments, as in acute eczema. For rhus toxicodendron poisoning Duhring recommends the extract of grindelia robusta, one fluidram to four to six fluidounces in water. We have used a saturated solution of boric acid with good effect; also calamin lotion and black wash, followed by oxid of zinc ointment.

Dermatitis Medicamentosa.—As a rule, the ingestion of drugs, especially in children, does not produce an eruption, yet the number of drugs which may produce disturbances of the skin is considerable and may cause difficulties in diagnosis. It is usually due to an idiosyncrasy, to some defect in the elimination, or to a poisonous dose, or, perhaps, a combination of these conditions. Acetanilid produces a bluish tint of fingers and lips—a cyanosis.

Antipyrin (phenazone) causes an erythematous rash, morbilliform in character, and desquamation may follow. The eruption becomes confluent in patches. An important practical point here is, in a febrile case of a child, cause not known, not to give antipyrin as a febrifuge, as the drug may bring out an erythematous rash and mask the true nature of the disease. The rash of arsenic is erythematous or urticarial, or herpes zoster may be produced at times (J. Hutchinson). Atropin (belladonna) produces a diffuse erythematous blush, scarlatiniform, especially in children. The differential diagnosis is fortunately readily established by the dryness of the throat, dilated pupils, and the absence of fever and of desquamation.

Bromids.—The great majority of eruptions met with in con-

nection with this group of drugs are pustular. They are usually acneform, and occur in the favorite sites of acne, viz.—the face, chest, back, and scalp. Sometimes they are furunculoid or bullous. In infants the eruption is liable to become confluent (Crocker). The lesions often continue to come out even after the use of the drug has been suspended.

Treatment.—Discontinue the drug and give arsenic internally. In cases of epilepsy, when bromids are necessary, the addition of arsenic will often prevent the acneform cutaneous lesions.

CHLORAL HYDRATE.—Skin-lesions resulting from chloral are mostly erythematous, dusky red papules or a general scarlatiniform rash, followed by desquamation. "The oral and pharyngeal mucous membrane is also red, increasing the liability of its being mistaken for scarlatina, as a rise of two or three degrees of temperature is not uncommon" (Crocker).

IODID eruptions are mostly pustular, acneform, appearing on the neck, shoulders, arms, and chest. They are also bullous at times, and may be erythematous, papular, hemorrhagic, or purpuric.

OPIUM eruptions are erythematous, scarlatiniform, often accompanied by pruritus, especially of the nose, but this may be general.

QUININ eruptions are usually erythematous and may be urticarial.

TURPENTINE eruptions are erythematous.

ECTHYMA.

Ecthyma is an inoculable and an autoinoculable disease of the skin, characterized by the formation of one or more rounded pustules resting upon an inflamed base and having a tendency to spread eccentrically, with the formation of a brownish crust. It closely resembles pustular eczema, but in this country is differentiated from it clinically. It begins as a red point, on the second day appearing as a small papule or pustule in the center of an inflamed area; on the third day it becomes accuminated in the center; it then increases in size to the fifth or eighth day, when it becomes a large, flattened pustule; by the ninth or eleventh day the central crust is formed, surrounded by a whitish circle, formed by the elevation of the epidermis by pus; thence it begins to heal, and by the fifteenth or twentieth day the lesion begins to disappear, leaving a more or less reddish-brown pigmented stain. Superficial cicatrices may result if the destructive ulceration has been deep enough. Ecthyma usually attacks the

lower limbs, although appearing elsewhere. There are slight itching and burning. Furuncle differs from ecthyma by its more vivid red color and deeper infiltration. It may be transferred from one part to another by scratching, whereupon new lesions arise by inoculation, and it usually appears in debilitated people.

The **treatment** is systemic and tonic—extra diet, pepsin, cod-liver oil, and iron in the form of Basham's mixture. Locally, antiseptics and parasiticides are necessary. The crust should be removed by a starch poultice containing boric acid, and the lesions washed with sublimate solution and dressed with an ointment of boric acid 1 dram, calomel 15 grains to the ounce of oxid of zinc ointment.

ECZEMA.

Eczema is the most common disease of the skin in this country, constituting from one-fourth to one-third of all cases. It is of almost infinite variety and distribution, and closely simulates a large number of other skin disorders. It is usually disfiguring and painful through the intensity of the itching and burning which accompany its progress. Eczema is an inflammatory, acute, or chronic disease of the skin, characterized at its commencement by erythema, papules, vesicles, or pustules, or a combination of these lesions, accompanied by more or less infiltration and itching, ending either in discharge, with a formation of crusts, or in desquamation. It is also described as a catarrh of the skin, affecting as it does the mucous layer. As encountered in children it has much the same features as in adults, but occupies certain situations more frequently in a child, as the scalp and face. It is also of a more acute, inflammatory type, and there is greater evidence of glandular enlargement, abscesses, and boils, especially in ill-nourished children or those of depraved vitality. The enlarged glands rarely suppurate. In former times all these were regarded as forms of sympathetic adenitis; it is, however, not an evidence of constitutional disease, but merely a sufficient irritation for which pediculosis capitis is an ample cause. Eczema in children may be acute, arising *de novo* from various causes, both general and local, and is then quite manageable. It is much more commonly met with as a subacute disorder following in the wake of a host of causes, the diverse forms of dermatitis and various specific diseases of the skin and the exanthemata. Eczema may occur as a localized patch upon the cheeks or scalp or under the chin, or generalized, scattered over the body and limbs in infiltrated patches of various sizes, appear-

ing scaly, in aggregations of papules, or in weeping and raw surfaces.

It may, at times, be inveterately chronic, defying the wisdom of the elect, and obdurately resisting every effort at relief, until the patience of the medical adviser is exhausted along with his wisdom, and to shield himself he may claim that to cure it at this stage would be "to drive it in and imperil life." Again, a critical epoch, such as the eruption of certain teeth, the period of puberty, a change in climate or in the weather, the rotation of the seasons, or, what is often very efficacious, a complete alteration in the environment and feeding, brings relief.

The form of the eruption may be the typical one of erythema, papules, vesicles, or pustules, all of which may not be present at the same time, one form merging into another; but usually one will predominate. Any one of these may develop into eczema rubrum, which exhibits a red, raw, weeping surface due to the exposure of the rete mucosa, a shedding of the upper epithelial layers. Squamous or scaly eczema may also follow upon any of these primary forms, appearing in patches of red, scaly, and thickened skin. Finally, by reason of the duration of the disorder or its position upon tougher or tenderer parts of the skin, there may arise a bark-like hardness or horny, cracked, or fissured conditions. The most important symptom by far is the itching; this is the real disease, and passes the descriptive capacity of most sufferers, and likewise overwhelms their endurance. Eczema bears a close similitude to catarrhs of the mucous membrane, both in its habit of discharge and tendency to relapse. To be sure it often happens that the exudate is scanty, and eczema may remain a dry disease throughout its course, but it is capable of being made at any moment a wet one by sufficient irritation and scratching.

Cause.—Eczema is the most frequently occurring skin disease in childhood. It is a catarrhal inflammation of the skin to which the delicate tissues of childhood are especially liable, and from exciting causes the most numerous. There is a predisposition in some children to skin troubles, or rather to a vulnerability of the skin, probably because it is not well developed or because the individual has feeble resistance. In badly nourished children of lowered vitality from defective hygiene and constitutional inheritance eczema is most likely to arise, especially the pustular form, and it is frequently accompanied by swollen glands, ciliary blepharitis, and mucopurulent conditions of the ears. Vaccination is a common cause or, rather, an irritative starting-point in a susceptible child; so is measles, in which it often attacks the edges of the

eyelids. The dietetic errors competent to initiate eczema are of large variety; too much food, especially of a coarse or improper kind, is quite as bad as too little. A food overrich in proteids seems to be hurtful, and certainly helps to produce one of the causes, which is overacidity of the blood; also such foods as readily induce gastric acidity, such as undercooked oatmeal, with sugar and cream, is recognized as a direct cause. Dentition is blamed unduly for inducing eczema, but it is merely one ground for susceptibility to irritation. There are many exciting causes: cold and damp weather, depressing heat, bad soaps, hard bathing water, and rough underclothing. There is a large variety of organisms capable of producing eczema, especially when the secretions have undergone decomposition.

Treatment.—To be accomplished in the treatment of eczema is a possession in itself. So rarely does the average practitioner attain this distinction that it is well worth choosing as a special subject of study. This can not be acquired, or only through infinite labor and pain, unless the student has an opportunity, of which he shall avail himself adequately, to work in a skin dispensary for a considerable time under the tutelage of a master of the art; such has been the authors' privilege, and so large and difficult is the subject, and so many failures have followed our efforts, that the wonder is how any one could get along without a similar experience. We have had very good success in treating eczema in babies and children upon this general outline: First, to regulate the diet, which in most instances requires thorough revision; next, to use some laxative and alkaline medicine which shall relieve both the bowel of offending matters and expedite the flow of urine and lessen its hyperacidity; then comes the enforcement of rather more rest and sleep than the child has been accustomed to get; the relief from excitement of all kinds as much as possible. The room in which the baby is kept should be of a southern exposure, defending it against heat in summer, as much as possible, and cold in winter, and dampness at all times. A common room or living room wherein cooking and washing takes place, often simultaneously, alternating with clouds of steam and burnt-up air from red-hot stoves and ranges, is most pernicious to tender skins and mucous membranes, producing catarrh of the respiratory passages, eyes, and mouth, and also producing catarrhal conditions of the skin, of which eczema is the chief. Such a room is also in a perpetual cycle of overheat or overcold. In children of the well-to-do classes this danger is, of course, escaped, and among them eczema is not so prevalent. They also escape another danger

of the more ambitious of the poorer folk, who are overzealous in their use of soap and water. The final important hygienic consideration, then, is care in the pursuit of personal cleanliness, in which, among babies, not so much soap should be employed and a better article selected. It is not a question of cheapness, for good Castile soap costs no more than the ever-handy laundry soap, which is found so efficacious upon pots and pans and is made to do efficient duty on the very dirty child. Again, whatever soap is used, be it good or bad, it should be completely washed away after having been applied, which in infants and children should always be sparingly. A good practical rule is to insist in the final use, during the process of ablution, of another cloth and cooler water, which will make sure of a final riddance of all soap. Moreover, the water used warrants care, and it is well that it should be boiled before using.

So much for prevention as well as cure. When an eczema is present, or a dermatitis from which it may come, the first rule is to insist that no soap whatever shall be used, and only lukewarm boiled water (better still, saturated solution of boric acid) sparingly for cleansing purposes. To this may be added, with great advantage, a solution of bran, made by taking a handful of bran, wrapped up in a loose meshed cloth, dipped in hot or boiling water, and then stirred about and finally squeezed into the bath water. To this it is sometimes well to add a teaspoonful of bicarbonate of soda or of washing ammonia to a basinful, and, if there is much itching, from fifteen to twenty drops of carbolic acid or essence of mint, one or all. The carbolic acid has a certain danger unless cautiously used and in limited areas. Lastly, as a protective as well as a cleanser, sweet oil; by this is meant olive oil, when procurable, not cotton-seed oil, to each ounce of which add one to five grains of carbolic acid.

For large areas in babies a boric acid ointment—boric acid one dram, petrolatum one ounce—is safer and better. This, applied after a water-bath, defends the skin from irritation of clothing or moisture or whatever cause, and if the eczema is quite annoying, used upon a soft doppel of cotton will serve admirably in lieu of the water bath. Under this treatment most eczemas of infants will get well. In addition to this may be used powders, antiseptic and soothing,—powders should always be both,—or sometimes an ointment is needed, first soothing and later stimulating. It will be noticed—and observant mothers will volunteer this information—that eczema of the exposed parts, as the face or head, is obviously worse in damp, stormy weather or when melting snow is about, and grows conspicuously better as soon

as a dry air prevails. Children with susceptible skins will need to be protected by veils when abroad, and, indeed, should not be allowed to go out in very bad weather. The ideal condition for an eczematous child is a large room opening to the south, with abundant window light, heated in such a way as not unduly to parch the air, and in which a number of healthy, growing plants are placed. The plants aid materially in regulating the atmospheric moisture in the most beneficent way. Such a room needs very little artificial heat, especially in sunny weather; the children can be dressed as if for out-of-doors. Indeed, it is always better for children able to play about alone to have a thoroughly ventilated room, like the one described, and to use extra clothing rather than artificial heat for warmth. The disease in young infants is usually acute; first, erythematous eczema, then papular, rapidly running into vesicular, then, as affected by scratching and rubbing, there results the pustular or the red weeping eczema; accompanying is a certain degree of infiltration, and along with this a severe and painful itching, and the disease is extended by the aggravation induced by scratching and rubbing. It is a matter of amazement what an enormous strain from this infants can endure for weeks and months. In adults it would induce a prostration of the nervous forces most disastrous. But, as has been said by Dr. White, of Boston, it not seldom happens that a whole household is exhausted in its endeavors to relieve the sufferings of an infant, who not only retains its vigor and plumpness, but in the end is the only healthy member of the family. An ancient fallacy prevails still in remote places, and be it asserted with caution, too, in high places in our midst, that it is in some sense perilous to apply local remedies, which may endanger the patient's life by driving the disease inward. This is a rag of the ancient humoristic theory, used as a skeptic cloak to cover ignorance.

Van Harlingen lays down "two general principles which obtain in regard to the local treatment of eczema; these are, first, that in the acute form the treatment can scarcely be too soothing; second, that in the chronic form the treatment can hardly be too stimulating. So long as there are eczema and hyperemia there will be itching; so long as there is itching there will be scratching; so long as there is scratching there will be no chance for the excoriated skin to heal." The infant or young child can not be wrapped up in a cloth, swaddled in fact, in lotions or ointments, but these must be applied in such a way as to permit freedom of movement; therefore one of the most valuable devices is the close-fitting garment devised by Dr. White,

made of linen or lint, on which these may be applied, and forms a protective coating to the inflamed skin. This consists of a mask, fitting the head and face, with apertures for the eyes, nose, and mouth, and slits for the ears. It is, perhaps, best adjusted by safety-pins, and worn for twenty-four hours, or changed at shorter or longer intervals. It is wise, also, where the trunk and limbs are affected, to use a sort of strait-jacket in addition to the mask, and it is well that it should cover the hands and feet also; the covering of the hands defends the skin from scratching. This will immensely shorten the course of the disease. Local remedies must be selected with strict attention to the character of the lesions in each individual case. Acute eruptions should usually be treated with soothing remedies. If crusts form, they had best be removed by boric acid ointment (one dram to one ounce) before decomposition with its consequent irritation sets in. If itching is severe and aggravated by the rapid formation of vesicles, these should be allowed vent; when there is extensive infiltration along with itching, stimulating measures are required. To soften down the crusts a starch poultice is of value, to which should be added 10 parts of boric acid to 1000. This gives great relief, and should be changed from every three to six hours. In less severe cases muslin dipped in bran or starch water and covered with waxed paper will do very well.

Acute Eczema.

In the choice of a remedy to relieve acute eczema it is better to begin by making the application over a limited area until its effect is learned. In this way several remedies can be used if the affected areas are extensive, and that which produces the best effect can then be chosen. Cautious experimentation is essential to success. A powder, mostly of starch, is best suited for large surfaces, to which may be added lycopodium, bismuth, talc, dermatol, or other suitable powder in experimental patches. Moist applications are oftentimes soothing and represent a continued bath. The starch poultice is one of the most reliable of the moist applications, adding 5 to 10 parts of boric acid to 1000, as previously described. Potato starch is preferred. It may be made by placing the starch in a flat bag, dipping in boiling water, and cooling; or ordinary washing starch rubbed into a smooth paste with cold water and spread upon linen and fastened with bandages may be used. This remedy gives great relief if used carefully and changed from every three to six hours. For the ordinary run of cases a decoction of bran or starch water

applied on soft muslin and covered with thin impermeable cloths will suffice. If the same cloths are reapplied, they must be disinfected each time and creases and folds avoided. If the patient becomes chilly from these wet dressings, a layer of cotton-wool or flannel may be placed over them. A good routine plan for acute eczema is to begin by bathing the part with diluted black wash, or the following modification of it:

℞. Hydrarg. chlor. mite, ... ℥ss
Mucilago tragacanthæ, ... ℥j
Liq. calcis, ... f℥xj.
Apply on cloths laid on the skin for a few minutes.

Then, with the finger, gently rub into the surface, before it becomes dry, the following ointment:

℞. Ung. zinci oxidi,
Ung. aquæ rosæ,
Petrolat., ... aa ℥iv.

Or Lassar's paste:

℞. Acid. salicyl., ... gr. x
Zinci oxidi,
Pulv. amyli, ... aa ℥ij
Petrolat., ... ℥ss.
Apply three times daily after first cleansing the surface with cosmolin.

Other washes recommended are these:

℞. Liq. plumbi subacetat. dil., ... Oss
Glycerin., ... ℥ss.

Also:

℞. Ext. grindeliæ robustæ, ... f℥ss-j
Aquæ dest., ... Oj.

These last may be applied on cloths and remain until dry.

For the relief of itching, cloths wrung out of hot water, laid on in succession, are of use. Carbolic acid, the most efficient antipruritic, must be used with extreme caution in the acute stages. It may be added to the black wash along with a little glycerin, and is always useful, but only free from some danger of absorption and poisoning if the skin is unbroken. Ointments in certain cases suit better than lotions. Cold cream is a better base for ointments for children than lard or vaselin. Oleate of zinc is a useful addition to some ointments:

℞. Zinci oleat.,
Ung. aquæ rosæ,
Ol. amygdalæ, ... aa ℥ss.

The oleate of bismuth and the saturated solution of boric acid are also recommended; or:

℞. Resorcin, ... gr. x
Glycerin., ... ♏x
Bismuthi subnit., ... ʒss
Liq. calcis, ... f℥j.

For oozing and itching areas:

℞. Bismuth. oxid., ... ʒj
Acid. oleic., ... ʒj
Cera alba, ... ʒiij
Vaselin, ... ʒix
Ol. rosæ, ... ♏ij.

Rub the oxid of bismuth with the oleic acid, and let it stand for two hours, then place in a water-bath until the bismuth oxid is dissolved. Add the vaselin and wax, and stir until cold. Among other soothing dressings may be mentioned cucumber ointment, glycerol of starch, a pure almond and olive oil, and diluted glycerin, one part to four or six of boiled or distilled water.

Chronic Eczema.

"Acute" and "chronic," used in describing states of eczema, are misleading; we may have an "acute" attack on top of an old chronic case induced by digestive or other disturbances. This must then be treated as an acute eczema by soothing measures only until this feature of the condition is under full control.

In most cases of subacute or protracted eczema the soothing treatment used in the acute form is alone suitable. It will occasionally be necessary, however, to make use of more stimulating remedies. Carbolic acid or resorcin are then the most valuable remedies. Preparations of tar are to be used with caution, as they may disagree and cause more inflammation, and are more suited to the inveterate chronic condition where there are desquamation and more or less infiltration. The portion of tar should rarely be more than from ten to forty grains to the ounce. The form may be the pix liquida or the oleum cadinum, the effects of which are practically identical.

For eczema of the scalp:

℞. Hydrarg. ammoniat., ... gr. xx
Petrolat., ... ʒj.

The red oxid of mercury, from two to thirty grains to the ounce, is useful. A mild mercurial ointment is the ammoniated mercury, from ten to twenty grains to the ounce, given above, and is suitable for the pustular eczema of children.

Preparations of tar must be thoroughly rubbed into the skin by a mop or the fingers of an attendant. Soap plays an important part in the treatment of some forms of eczema. Ordinary washing-soaps had best be used as little as possible. Strong alkaline soaps are used to stimulate stubborn patches or to remove infiltrations. A useful preparation for cleansing areas when covered with accumulated crusts and scales is:

℞. Sapo viridis, ... ℥ij
Alcohol., ... ℥j–ij.
Dissolve with heat and filter.

This is a powerful stimulant and cleanser, rubbed in with a mop, taking great care to wash it all thoroughly out again with hot water; the surface is then dried with soft cloths, and a soothing ointment applied.

Other remedies for chronic eczema are mercurial preparations, useful only in limited areas and always with extreme caution:

℞. Hydrarg. chlorid. mit., ... gr. v–xx
Ung. zinci oxidi,
Petrolat., ... aa ℥ss.

Sulphur and resorcin are valuable in some forms, particularly in eczema seborrhœicum, in ointments of from ten to twenty grains to the ounce of cold cream. Lassar's paste is useful here as well as in the acute forms. (See formula, p. 753.)

The treatment of eczema must include internal medication of such a kind as shall correct obvious disturbances. These are mostly digestive, and the remedies are outlined elsewhere. It is usually important to make occasional use of laxatives as well, sometimes in quite a long course, especially in older children. Diathetic conditions, such as uricacidemia, are frequently a factor, or vasomotor disturbances of central origin, requiring both internal and external measures for their relief. Nutritional tonics are then needed, even though the subject exhibit no obvious deficiency.

The Use of Arsenic in the Treatment of Eczema.—As a rule, this drug given internally causes more harm than good. It acts as a direct nerve stimulant and exerts its influence on the mucous layer of the epidermis. In the acute stages, when rapid cell changes are taking place, accompanied by heat, burning, and intense itching, the drug should never be administered, as it stimulates the already inflamed mucous layer when rest is desired. Generally speaking, this rule holds good for the acute inflammatory stages of any disease of the skin. In psoriasis, for example, the drug should be withheld while the disease is

rapidly spreading and until the acute symptoms have subsided. Arsenic is never to be used against the skin-lesions themselves, but only in well-selected cases, when the underlying cause of the disease is a debilitated or run-down condition of the nervous system. The remedy is best administered to children in the form of liquor sodii arsenitis, ½- to 2-minim doses, according to age, well diluted. This solution is less disturbing to the digestive tract than the potash salt.

Differential diagnosis may be made between eczema and other disorders which often resemble it by comparing the following admirable tables (from Van Harlingen):

Eczema Erythematosum.	Erysipelas.
1. Not contagious; frequently history of eczema elsewhere.	1. Frequent history of contagion.
2. Accompanied by mild symptoms.	2. Well-marked constitutional symptoms.
3. Little or no edema, but some infiltration, shown by the thickness of the skin on pinching up a roll between the fingers. Surface dull and red and often slightly scaly.	3. Shining redness; skin tense; marked edema.
4. Not a creeping disease, though it may spread irregularly.	4. A creeping eruption, spreading peripherally.
5. Inflammation less acute and more superficial.	5. Inflammation very acute and deep-seated.
6. Itching perhaps more marked than burning.	6. Intense burning and little pruritus.
7. Not apt to be painful on pressure.	7. Usually very painful on pressure.
8. Not infrequently some secretion at one stage or another.	8. No discharge except from ruptured blebs.
9. Vesicles form early, if at all.	9. Vesicles, or rather blebs, form late.
10. Runs a chronic course.	10. Runs a rapid course.
11. No line of demarcation.	11. A distinct line of demarcation.
12. No rise of temperature.	12. Always a rise of temperature.

Eczema Papulosum.	Urticaria.
1. History of eczema.	1. Often a history of error in diet, or dyspepsia.
2. Eruptions may appear more gradually.	2. Eruptions appear suddenly.
3. Often extensive.	3. Usually not extensive.
4. Lasts usually for weeks.	4. The separate attacks may last but a few hours.
5. Absence of blood crusts, excepting in connection with the papular lesions.	5. Frequent presence of blood crusts from scratching the only evidence of the disease.
6. Usually accompanied by other forms of eczema.	6. Not accompanied by other forms of eruption elsewhere.
7. Itching severe. Not so much burning as pricking. Not so markedly aggravated by currents of air, etc.	7. Itching, tingling, pricking, and burning intense. Usually aggravated by currents of cold air, undressing, etc. Often intense nervousness.

ECZEMA PAPULOSUM.—(*Continued.*)

8. Eruption remains the same for days.
9. Skin not especially irritable.

URTICARIA.—(*Continued.*)

8. Exacerbations may occur in a few hours.
9. Welts form immediately on irritation of the skin.

ECZEMA VESICULOSUM.

1. Begins with slight burning or itching.
2. Vesicles seldom form distinct groups.
3. Vesicles tend to run together.
4. Vesicles small.
5. Vesicles tend to rupture.
6. Formation of crusts.
7. Eruption accompanied by more or less intense itching.
8. No special arrangement of lesions.
9. Eruption occurs on both sides.

HERPES ZOSTER.

1. Neuralgic pains a premonitory symptom.
2. Vesicles are arranged in distinct groups.
3. Vesicles markedly distinct and independent.
4. Vesicles large.
5. Vesicles do not rupture spontaneously.
6. No crusts unless vesicles are accidentally ruptured.
7. Burning pain, often lancinating, accompanies the eruption.
8. Eruptions follow the course of some nerve.
9. Eruption limited to one half of the body.

ECZEMA SQUAMOSUM.

1. Presence of moisture at some time.
2. Skin red and thickened.
3. Scales more firmly adherent.
4. Ears frequently attacked.
5. Alopecia less frequent, and the hair usually returns after the eczema is cured.
6. Hairs frequently matted together.

PITYRIASIS CAPITIS.

1. Always a dry disease.
2. Skin not thickened nor inflamed.
3. Scales easily detached.
4. Disease limited to scalp.
5. Frequently more or less baldness ensues after a time.
6. Hairs surrounded by a scaly sheath.

ECZEMA SQUAMOSUM.

1. Eruption fades gradually into surrounding skin.
2. Scales thin and scanty.
3. Presence of moisture at some stage.
4. Lesions change in character from time to time.
5. Scales small and yellowish.
6. Intense itching.
7. Patches of eruption large and irregular.
8. No seat of predilection.
9. No uniformity of lesions.
10. Considerable induration of patches.
11. Ears and face frequently attacked in eczema of the scalp.

PSORIASIS.

1. Patches of eruption sharply defined.
2. Scales thick and abundant.
3. Eruption always dry.
4. Eruption remains the same from week to week.
5. Scales large and pearl-like.
6. Itching less severe.
7. Patches of eruption smaller and round.
8. Seat of predilection on knees, elbows, etc.
9. Great uniformity of lesions.
10. Less induration, but greater vascularity.
11. When affecting scalp, usually limited to hairy parts, just extending to the edge and limited by an abrupt line of demarcation.

Eczema Papulosum.	Lichen; Ruber Planus.
1. No desquamation.	1. Desquamation.
2. Lesions remain papular for weeks.	2. Remain papular for months.
3. Severe itching.	3. Usually slight itching.
4. Papules rounded and more or less acuminate.	4. Papules flat, slightly depressed, and some umbilication in the center.
5. Papules rounded in outline.	5. Papules have a peculiar squarish or angular outline.
6. Color of lesions bright red.	6. Color of lesions dull red or violaceous.
7. Lesions irregularly arranged.	7. Lesions seem sometimes to follow nerve-trunks.
8. Little or no subsequent pigmentation.	8. Lesions have some pigmentation or staining.
9. Papules often unite, losing their identity.	9. Papules retain their individuality, although forming patches.
10. Health remains good in most cases.	10. Health often impaired.

Eczema Squamosum.	Pityriasis Rubra.
1. Redness occurs in patches.	1. Uniform redness.
2. Intense itching and some burning.	2. Slight itching and no burning.
3. Scales small and bran-like.	3. Scales large and papery.
4. Scales form slowly.	4. Scales reproduced rapidly.
5. Skin infiltrated and thickened.	5. Skin not infiltrated.
6. Exudation present at some period.	6. Process always a dry one.
7. Scales not very abundant.	7. Scales very numerous.
8. Affection common.	8. Rare disease.
9. General health remains good.	9. Severe constitutional disturbance after disease has lasted some time.

Eczema Squamosum.	Tinea Circinata.
1. Eruption usually irregular.	1. Eruption circular in form.
2. Margins ill defined.	2. Margin well-defined and raised.
3. Scaling bran-like and abundant.	3. Slight, shreddy desquamation.
4. Not contagious.	4. Communicable.
5. Irregular character of eruption.	5. Eruption ring-shaped.
6. Does not heal from center.	6. Tendency to heal from center.
7. Usually a chronic affection.	7. Disease runs an acute course.
8. Nonparasitic disease.	8. Presence of mycelium under the microscope.

Eczema Pustulosum.	Favus.
1. Nonparasitic disease.	1. Peculiar vegetable parasite to be found in abundance under microscope.
2. Not communicable.	2. Contagious.
3. No peculiar odor.	3. Lesions have a characteristic mouse-like odor.
4. Exudation purulent.	4. Exudation dry and powdery; canary-yellow lesions, cup-shaped, hair protrudes through center of cup.
5. No permanent loss of hair.	5. Eruption gives rise to scars and alopecia.
6. Hairs appear normal.	6. Hairs brittle, dry, and wiry.
7. Eruption never ends in ulceration or cicatrization.	7. Disease may result in cicatrization.
8. Crusts moist and sticky.	8. Crusts dry and friable.
9. Acute course of disease.	9. Very chronic affection.

Eczema Papulopustulosum.	Scabies.
1. Nonparasitic disease.	1. Presence of parasites.
2. No burrows.	2. Presence of burrows, pathognomonic.
3. Not communicable.	3. Very contagious.
4. Vesicles and pustules confluent.	4. Vesicles, papules, and pustules discrete.
5. Eruption sudden and not progressive.	5. Eruption progressive.
6. Vesicles clear.	6. Irregular dots on vesicles.
7. Pruritus less severe.	7. Itching intense, especially at night.
8. No special seat of election.	8. Lesions found especially between fingers, on flexor surface of the wrists, on anterior folds of axillæ, about nipples, on shaft or head of penis, buttocks, popliteal spaces.
9. Scalp may be affected.	9. Disease very rarely affects scalp; this does not apply to infants.*
10. Individual lesions usually small.	10. Vesicles and pustules often very large.
11. Vesicles usually rupture.	11. Vesicles do not rupture spontaneously.

Eczema Erythematosum	Syphiloderma Erythematosum.
1. History frequently of eczema.	1. History of chancre.
2. Eruption limited in extent.	2. Eruption diffuse.
3. Patches of eruption quite large.	3. Individual lesions small.
4. Intense itching.	4. Rarely much itching, if any.
5. Lesions bright-red color.	5. Coppery, fawn, or pale-rose color.
6. Usually accompanied by other forms of eczema.	6. Presence of other syphilitic symptoms.
7. Slight scaling, but no pigmentation.	7. No scaling, but pigmentation.
8. Skin thickening.	8. No induration of the skin.

Eczema Papulosum.	Syphiloderma Papulosum.
1. History of eczema.	1. History of syphilis.
2. Eruption usually limited in area.	2. Eruption extensive.
3. Superficial eruption.	3. Eruption deep-seated.
4. Eruption usually moist at one time or other.	4. Eruption dry from the first.
5. Severe itching.	5. Little or no itching.
6. Lesions less distinct.	6. Lesions have a firm, shotty feel.
7. Vesicles not infrequently associated with papules.	7. Distinctly papular.
8. Lesions more acute and active.	8. Lesions chronic and passive.
9. Lesions tend to group and unite.	9. Lesions usually discrete.

Eczema Squamosum.	Syphiloderma Squamosum.
1. History of eczema.	1. History of syphilis.
2. Eruption superficial.	2. Eruption deep-seated.
3. Intense itching.	3. Slight itching.
4. Eruption moist at one time or another.	4. No discharge.

* In infants whose scalps and faces are warm and moist from nursing in arms and lying in cribs the mite will flourish bravely.

Eczema Squamosum.—(*Continued.*)	Syphiloderma Squamosum.—(*Continued.*)
5. Eruption red in color.	5. Eruption ham-colored.
6. Scales abundant and thick.	6. Scales scanty and thin.
7. Infiltrations less marked and inflamed.	7. Infiltration of skin marked and cellular.
8. Margins indistinct and not abruptly elevated.	8. Margins elevated and well defined.
9. Heals first at edges.	9. Tendency to heal at center.
10. Lesions active and inflammatory.	10. Lesions passive and but slightly inflamed.
11. No secondary lesions except large, painful glands in neighborhood of eruption.	11. Presence of secondary lesions.
12. Eruption has an irregular outline.	12. Tendency to occur with circular outline.

Eczema Pustulosum.	Syphiloderma Pustulosum.
1. History of eczema.	1. History of syphilis.
2. Often itching.	2. Itching absent or moderate.
3. No bad odor.	3. Odor very disagreeable.
4. No ulceration.	4. Ulceration under crusts.
5. No scarring.	5. Lesions leave scars.
6. Eruption usually confluent in large patches.	6. Lesions discrete or form small, irregular patches with circular outline.
7. Scales less prominent and never stratified.	7. Scales prominent and often in the form of rupia (oyster-shell like).
8. Vesicles present at some stage.	8. Pustules usually occur alone.
9. Eruption develops rapidly and disappears sooner.	9. Lesions develop slowly and last long.
10. Crusts moist.	10. Crusts dry.
11. Scales less adherent.	11. Scales adherent.
12. Absence of secondary lesions.	12. Presence of secondary lesions.

ERYTHEMA.

Six varieties of erythema are worthy of mention: Erythema simplex, erythema intertrigo, erythema vaccinium, erythema variolosum, erythema multiforme, and erythema nodosum.

The first four are simply hyperemias, with little or no inflammatory exudation, while the last two are characterized by more or less plastic exudation. They all terminate without leaving a mark or scar. Erythema simplex is characterized by redness, occurring in patches, from whatsoever cause, in form of variously sized, diffused or circumscribed areas.

Varieties.—(1) Irritations caused by heat or cold, pressure or rubbing, irritating or poisonous substances; (2) symptomatic, due to some systemic disturbance, as disorders of the digestion or the blood. The treatment is the removal of the obvious cause, local or internal; locally, soothing or astringent lotions; bran decoction with soda with, it may be, a few drops of carbolic acid. The calamin lotion has a wide range of usefulness:

℞. Pulv. calamin., ... ʒiij
Pulv. zinci oxidi, ... ʒij
Glycerin., ... ♏xl
Liq. calcis,
Aq. rosæ, ... aa fʒij.

Ointments are apt to disagree and are less cleanly.

Erythema Intertrigo.—A common form of irritation occurring on the natural folds of the skin where these come in contact with each other and chafe, as about the buttocks, groin, and armpit. The skin feels hot and looks sore; perspiration macerates the epidermis and may cause an acrid, mucoid discharge; the cause is usually mechanical, by the rubbing together of two surfaces of skin or the contact of rough clothing, acid urine, salt sea-water, sweat, or irritating discharges.

Erythema intertrigo in an infant may resemble an erythematous hereditary syphiloderm, and an opinion should not be hastily expressed. At first the syphilitic eruptions disappear under pressure, but in the course of a few weeks the lesions become more marked, and appear in other portions of the integument than the natural folds, the lesions becoming infiltrated and change in color to a deep, yellowish-red, and moist papules will show themselves. Mucous patches, fissures of mouth and anus, sniffles, hoarseness, wizened appearance, etc., will readily make clear the diagnosis.

The *treatment* is cleanliness and care to keep the parts asunder. Smooth bits of linen or wads of absorbent cotton placed in between are comforting and preventive.

℞. Pulv. acid. boric., ... ʒj
Pulv. talc., ... ʒj.

This is a powder which will not ferment. Calamin lotion is also useful.

Certain other powders are useful: Oxid of zinc, stearate of zinc, bismuth, magnesia, fullers' earth, and calamin. In stubborn cases black wash diluted with lime-water, dilute alcohol, with alum or sulphate of zinc (weak solution: zinc sulphate, ½ to two grains; water, one fluidounce), followed by a powder, are useful. If hyperhidrosis occurs about the genitalia, etc., belladonna may be added to the lotions. If the digestion of a child is disturbed, alkaline laxatives and diuretics may be given, to which a bromid may be advantageously added.

Infantile erythema (roseola), common in infants suffering from gastric disturbance or febrile complaints, occurs chiefly on the trunk, and may be mistaken for scarlet fever or measles.

Erythema vaccinium (roseola vaccinia) occurs frequently a day or two after vaccination, extending over the trunk and

extremities, and sometimes induces the fear of syphilitic infection. This last has a much longer incubation period, and is of a dusky red, and not the usual fawn color of the syphiloderm.

Erythema variolosum, one of the prodromal rashes of smallpox, appears in a characteristic locality, over the abdomen and inner side of the thighs, the dorsal surfaces of hands and feet, and the axillæ. It may be accompanied by redness of the pharynx. In a few days the diagnosis will be made clear.

Erythema multiforme is very like erythema simplex, but more severe; it manifests itself as erythematous patches of most varied shapes and sizes, or as papules, vesicopapules, and tubercles, scattered or in groups. The papular type is the most common. With or without symptoms of malaise or rheumatic pains the lesions appear suddenly. These soon fade and seldom last longer than a week or ten days; though very severe looking, the lesions disappear spontaneously, leaving perhaps slight pigmentation or desquamation. They occur symmetrically, are usually seen on the backs of the hands, feet, and knuckles, but may be more or less general, appearing in the spring and fall. As a rule, no subjective symptoms are complained of.

Erythema iris is erythema multiforme when we have a play of colors in the lesions. One or more rings concentrically arranged may appear, giving the lesion a target-like appearance.

Herpes iris is simply erythema iris gone on to vesication. Here sufficient serous exudation has taken place to raise the epidermis from the tissues beneath in the form of vesicles or bullæ.

The **treatment** of erythema multiforme is very simple—quinin, salicylates, mild saline laxatives and diuretics, a carbolic acid wash, one to three drams to the pint of camphor water, adding a little glycerin and, perhaps, soda; dusting-powders may be used.

Erythema nodosum is an inflammatory disease characterized by rounded or oval, more or less elevated reddish nodes. It is ushered in by some systemic disturbance and rheumatoid pains, with swellings around the joints. The nodes appear suddenly on any part of the body, but commonly on the legs and arms, especially over the tibia, the long axis of the node, parallel to the long axis of the tibia usually. They vary in size from that of a small nut to that of an egg, are usually slightly elevated, are reddish at first, tending to become purple or blue, and as they disappear turn yellow, simulating bruises. When the nodes are at their height they look as though they contained fluid, and they may be hemorrhagic. They never suppurate. The disease occurs most frequently in children and young adults. The lesions

come out in crops from a few to a dozen or more, usually attended by a sensation of heat, and are tender on pressure. The duration is from one to four weeks.

The *treatment* is constitutional and local. Salicylates are called for and, locally, soothing applications—lead-water and laudanum, hot fomentations. Rest, absolute or relative, according to the severity of the attack and the region affected, is indicated.

FURUNCLE.

Synonym.—Boil.

Furuncle, commonly known as boil, is a deep-seated inflammatory disease characterized by one or more variously sized, circumscribed, large or small rounded or acuminated, firm, painful formations, usually terminating in a central suppuration. Boils may occur singly, in groups, or often in successive crops. The lesion begins as a small, ill-defined red spot in the true skin, tender and painful from the first, becoming larger, elevated, and showing a tendency to suppurate about the center. It matures in about a week or ten days in a slightly raised or pointed formation, with a suppurating center, called the core. This core may not form, and it is then called a "blind" boil. It usually produces a dull, throbbing pain, which increases until suppuration takes place, and then subsides. Sometimes there is sympathetic constitutional disturbance; neighboring glands may be enlarged. Boils not seldom occur in the course of other diseases, and occasionally at certain seasons, as in the spring and autumn, appearing as an epidemic. Boils differ from anthrax or carbuncle in having but one point of suppuration; the carbuncle has many, is flat, varies in size from half an inch to four inches in diameter, and while painful, is not tender, as furuncle is.

Frequently in children there occurs the condition known as furunculosis, or crops of usually small pea- to bean-sized or larger phlegmonous papules or papulopustules. These run their course, fresh crops appear, and thus the process continues, sometimes for long periods, if untreated. These boils do not form any definite group; they are usually scattered over one or several portions of the body, are usually isolated, and occur on the trunk, limbs, forehead, and scalp. They are frequently connected with excessive sweating. We have seen them in infants follow an attack of miliaria papulosa (prickly heat), and exist in considerable numbers.

Treatment.—The object is to destroy the cocci in each boil,

and thereby exhaust the supply. Open the pustules surgically and gently express the pus (rough handling of a small boil may readily convert it into a large one), after which apply three or four times daily the following, which we have used with marked benefit and can highly recommend:

℞. Ichthyol, ... ♏xx
Acid. boric., ... gr. xv
Aq. destil., ... f℥j.
M. Sig.—Apply to surface, using an atomizer.

Used thus, the application causes no pain to the infant or resistance of the little sufferer, and new crops will not appear, as the soil is made unfavorable to the growth of the staphylococci.

The disease is regarded as due to the micrococci, especially the staphylococcus aureus, invading the sweat-glands or hair follicles. The soil also must be favorable for their development.

Since the staphylococcus pyogenes aureus has been demonstrated to be the cause of boils, parasiticides have come into use.

The following plaster spread on and kept in place is claimed to be of use:

℞. Acid. salicylic., ... ℥ij
Emplast. sapon., ... ℥ij
Emplast. diachyl., ... ℥j.
Sig.—Spread on cloth or kid, a crossed slit to be cut in this over the apex of the boil.

Ichthyol ointment, 12.5 to 25 per cent., in lanolin and petrolatum, rubbed in persistently for ten minutes, is one of the best means of aborting the local inflammation. When pus has once been formed, free incision should be made. Bulkley praises a mixture of—

℞. Acid. carbolic., ... gr. x
Ext. ergot. fluid., ... ℥j–ij
Ung. zinci oxid., ... ℥ij–iv.

Peroxid of hydrogen is then useful, not only as a cleanser, but as an antiseptic. This had best be applied in full strength upon absorbent cotton, at the end of a probe or stick or wire applicator. If poultices are used,—and they are often a great comfort,—they should contain boric acid and, possibly, laudanum.

HERPES ZOSTER.

Synonyms.—Zona; Shingles.

Zona, or shingles, is an acute inflammatory disease, characterized by groups of vesicles seated upon inflamed bases, following

the distribution of cutaneous nerves and accompanied by more or less neuralgic pain. The vesicles vary in size from that of a pinhead to that of a split pea, and they may coalesce, but the patches do not show this tendency. The eruption is almost always unilateral, and occurs over an easily traced nerve-trunk. New lesions continue to appear until the fourth or eighth day, remaining thus a few days, then gradually dry up, leaving brown crusts. Ten to twenty days is the average duration of an attack. The distress may be very slight or overpowering. These neuralgic pains occurring before the eruption manifests itself may give rise to the diagnosis of pleurisy, pleurodynia, or other localized suffering until the characteristic eruption of zoster makes the diagnosis clear. Of late years herpes zoster is being regarded as a more complicated affection than it was for a long time believed to be. The causal factors are: (1) Inflamed state of the nerves, ganglia, nerve-trunks, branches, or filaments; (2) season—most frequent in winter; (3) sudden temperature change; (4) infection; (5) internal use of arsenic (Hutchinson); (6) traumatism following injuries or surgical operations.

The **diagnosis** of herpes zoster can be made upon the prodromal neuralgic pain, but, as a rule, this is absent in the young; the vesicles tend to cluster in distinct groups upon a highly inflammatory base, and occur on a nerve tract, and unilaterally almost always, and the vesicles preserve their form intact. In eczema the lesions exude moisture, break down, and form crusts; in herpes zoster there is no discharge unless the vesicles are ruptured; they dry up and form crusts. Eczema itches; herpes zoster burns.

The **treatment** of herpes zoster is largely palliative; it is an acute, self-limited disease, running a very variable course. The neuralgic pain in children may be entirely absent, and if it is present, is liable to subside as the eruption becomes established. The main points are to prevent the vesicles from rupturing, to exclude the air, and to prevent the irritation of the clothing. Internally, the coal-tar analgesics are usually efficacious to control the pain. A powder of acetanilid or phenacetin three grains, bicarbonate of soda two grains, caffein ½ grain, codein $\frac{1}{10}$ to $\frac{1}{6}$ grain, every three hours, is useful for a child of ten; sometimes morphin is necessary. Bromids may be needed where nervousness is extreme.

℞. Pulv. camphoræ, ... gr. x
Pulv. talc, ... ℥j.
Sig.—Use locally.

The dusting-powder should be very freely applied to the surface and held in place by a large wad of cotton-wool to keep the whole from being moved about on the hypersensitive surface, and to avoid rupturing the vesicles, as infection may take place in the broken-down lesions and scarring result.

For localized patches menthol or resorcin in gutta-percha or collodion are excellent protectives. For extensive areas, especially about the gluteal folds, in the axillæ, lotions, as of laudanum, laudanum and lead-water, or fluid extract of grindelia robusta, diluted with water, give comfort. On limbs which must be used ointments can be made to serve a good turn, or oil of peppermint or chloral camphor painted on, over which a large shielding wad of cotton should be placed and firmly attached.

An important point in treatment is the residual neuritis, for which galvanism gives relief, or sometimes blisters on the central side of the nerve affected are useful.

IMPETIGO CONTAGIOSA.

Impetigo contagiosa is a highly contagious, autoinoculable disease, very common among children and almost entirely confined to them, running its course in about ten days or two weeks, and tending toward recovery. It may be defined more accurately as an acute, inflammatory, contagious disease, characterized by the formation of one or more superficial lesions, round or oval in shape, beginning as vesicles and rapidly becoming pustules which pass into crusts. At first the vesicles stand alone and are small in size, but soon spread out until they become the size of a small coin, over the top of which is spread out a thin membrane, soon becoming collapsed and withered looking. There may be few or many of these, alone or coalescing, especially about the angles of the mouth and around the ears or nose. In a few days yellowish or straw-colored crusts form which have the appearance of being loosely "stuck on" the skin, and are readily pulled off, leaving a moist, bleeding, or inflamed surface underneath. The course is about ten days, but we have seen it run along for weeks in much the same locality, doubtless by progressive autoinoculations. This last is a very common method of extension, and we have frequently seen painful lesions on the body, about the buttocks, or under the armpits, and particularly on the lower leg, which could be directly traced to an earlier mild attack of impetigo beginning upon the face, for which no treatment had been sought. The cause is staphylococci flourishing on a favorable soil. Impetigo is so well marked a dis-

order in its distribution, occurring as it does usually on the face and hands and beginning as flat, flaccid vesicles or vesicopustules, the dirty appearance of the pustules, the yellowish-brown, loosely attached scabs or crusts, the absence of itching, there are so constantly two or more children in a family affected with it at the same time, or there is an easily obtainable history of neighboring infection—that there should be little difficulty in differentiating it from pustular eczema, scabies, or that rare and illusive entity known as simple impetigo.

Treatment.—Impetigo contagiosa may get well of itself if left alone; but this the child will not do, but cherishes it and extends it all over his person by his hands or finger-nails, or transfers it to his little companions. It is important, then, to use some cleansing measures, of which soap and water do very well, but antiseptic washes, such as boric acid solution, are even better. There is no itching to contend with. Ammoniated mercury, from ten to twenty grains to the ounce of boric acid ointment, will usually suffice. The removal of the crusts and the application of some astringent antiseptic wash or ointment to the moist, inflamed surface will hasten the cure. As the seat of the disease is very superficial, mild antiseptic applications only should be prescribed.

MILIARIA.

Synonyms.—SUDAMINA; MILIARIA CRYSTALLINA; MILIARIA RUBRA; MILIARIA ALBA; LICHEN TROPICUS; PRICKLY HEAT.

Miliaria is an affection due to an obstruction of the sweat-ducts, either with or without inflammation. Sudamina, or miliaria crystallina, is the noninflammatory form. The fluid contained in the vesicles is pure sweat. Owing to the orifice of the duct being plugged by an obstruction, the sweat is effused under the horny layer. The vesicles are pinpoint to pinhead in size, closely crowded, but rarely confluent; their color is clear or pearly, and they occur mostly on the neck, chest, and abdomen. They resemble dewdrops. This variety occurs often in the course of typhoid and rheumatic fevers, especially by a "critical sweating." The fluid is absorbed in a few days, leaving slight desquamation.

Miliaria Rubra et Vesiculosa.—This is the inflammatory form. The inflammation may be primary or secondary, and develops in the sweat-pore area. When we have bright-red papules only, it is miliaria rubra; when we have vesicles or pustules on the summits of the lesions, it is miliaria alba.

The lesions occur chiefly on the trunk, are pinpoint to pinhead in size, closely crowded, but discrete. There is usually a diffuse redness of the affected area; more or less itching is complained of, most marked in the papular variety.

The affection runs its course in a few days, leaving slight desquamation, though successive crops may continue to appear. "Red gum," or strophulus, of infants is miliaria rubra due to too warm clothing.

Miliaria papulosa, "prickly heat," or lichen tropicus, is another variety of miliaria rubra. Here the inflammatory process is primarily in the sweat-glands and causes obstruction of the sweat-ducts. The eruption consists of bright-red, minute, closely crowded, but not confluent acuminate papules, with a few vesicles and vesicopapules scattered about between them. The eruption is preceded by profuse sweating, comes out suddenly, and is attended with intense itching and pricking. It mostly affects covered parts—trunk, limbs, and upper part of forehead—and is usually extensive. Prickly heat is most common in the tropics, but occurs in America during the summer. Too warm or ill-fitting clothing, the irritation of clothing, especially flannel, rapid alterations of temperature, seem to be predisposing factors. Children, fat people, and those who perspire freely are most liable to it. One attack predisposes to another.

Diagnosis.—The noninflammatory, pearly vesicles of sudamina can scarcely be confounded with anything else. Miliaria vesiculosa may be mistaken for vesicular eczema, but in the latter the vesicles rupture spontaneously; they form in patches, oozing is usually marked, and the process has a distinct tendency to spread, and is more chronic in its course. Miliaria papulosa, occurring only in hot weather, its sudden onset, associated with excessive sweating and the eruption confined to the sweat-glands, the minute papules, peculiar pricking instead of intense itching sensations—all differentiate this from eczema papulosa.

Differential Diagnosis.—Sweat rashes occurring in children are liable to be mistaken for some of the exanthemata, but the absence of the usual constitutional symptoms of measles, scarlatina, and Rötheln, and keeping in mind the localization of the eruption and the accompanying sweating, will usually make the diagnosis clear.

The **prognosis** is good, the disorder generally yielding to appropriate treatment.

Treatment.—Saline diuretics—acetate and nitrate of potash—and lemon- and lime-juice drinks are very useful. Locally, alkaline and bran baths (see p. 750) are beneficial; soothing, cool-

ing, or evaporating lotions will afford relief. We have used with marked benefit the lotion of resorcin and bismuth (see Eczema) and the calamin lotion. (See Erythema.) Dusting-powders of zinc, starch, and boric acid are useful.

PEDICULOSIS.

Pediculosis (lousiness) is a parasitic affection caused by the presence of lice. There are three varieties of pediculi—of the head, body, and pubes. The diagnosis is easy, and the scratch-marks must be carefully searched for. In the scalp and pubes nits, or ova, will be conspicuous. The parasite attacks the scalp and produces considerable irritation, which causes the patient to scratch; then follows effusion of serum, blood, or pus, the hairs becoming matted together. Pediculosis is a common cause of eczema in the back of the head. Sometimes a characteristic form of eczematous eruption can be seen about the mouth, nostrils, and ears, due to lice, but closely resembling impetigo contagiosa.

The **treatment** for head-lice is to apply kerosene or tincture of cocculus indicus overnight, and wash the hair with soap and water in the morning. This will kill the insects, but does not destroy the nits. Vinegar applied will soften the ova and aid in their removal. The hair need not be cut if care and patience are used in applying the remedies.

Body-lice produce considerable itching, which is usually followed by extensive scratches. Cleanliness with soap and water is usually sufficient in the care of children; the underclothing must be baked or boiled. This insect lives in the clothing, and only goes to the body to feed. A carbolic lotion may be necessary to relieve itching.

The crab-louse, though usually found on the pubes in the adult, is sometimes met in the other hairy parts, as the axillæ, but is only rarely met in children, and then in the eyebrows and eyelashes. This insect may be removed by cocculus indicus of full strength or diluted one-half, followed by vinegar or hot soapsuds, or, better,

℞. Hydrarg. bichlor., ... gr. j
Acid. acet. glacial., ... ♏xx
Aquæ, ... ad ℥j.
M. Sig.—Apply.

This is the most neat and elegant preparation, as the bichlorid destroys the insect and the acetic acid dissolves the nit, which can then be readily removed by a fine-toothed comb.

PITYRIASIS ROSEA.

Pityriasis rosea is a slight affection, self-limited and harmless, but worth mentioning because it is frequently mistaken for more important disorders. It is characterized by discrete or confluent macular or maculopapular lesions, from a pea to a half-dollar size; in color a rosy or pale red, with a more or less tawny or yellowish tint. The surface may be slightly or not at all raised, always dry or scaly, healing in the center and spreading at the edge, and when there is caused a ring-like appearance, it may be confounded with tinea circinata. The eruption is usually seen under the clavicles, on the side of the chest, or between the shoulders. It may be mistaken for syphilis, tinea versicolor, tinea circinata, or seborrhœa corporis; it may last from one to three months. It is not contagious, and requires little treatment, except, perhaps, a mild, stimulating ointment such as—

℞. Acid. salicylic., ... gr. x
Sulph. præcip., ... gr. xx
Ung. aq. rosæ, ... ℥j.

PSORIASIS.

Psoriasis is a chronic inflammatory disease of the skin, commonly showing itself in the form of variously sized scaly patches scattered over different parts of the body; these patches are usually rounded, sharply defined, and are covered by a mass of imbricated "mother-of-pearl" scales on a red base. When the scales are picked off, there is shown underneath a smooth, shiny, reddish surface, on which may be seen a few bleeding points. Psoriasis is always dry and scaly, never moist. It may occur in any part of the body, but most commonly on the extensor surfaces of the limbs, and especially on the knees and elbows. The back is a favorite situation, and it is frequently seen in the scalp. It is noncontagious, and may occur in healthy, well-nourished people or those who are slightly rheumatic. It is almost always symmetric; there is, as a rule, little or no sense of itching. In children the lesions are usually small and rather generally distributed. The elbows, knees, and scalp are liable to be the first parts attacked. A diagnosis needs to be made between psoriasis, seborrhea, eczema, and syphilis. In seborrhea of the scalp the scales are greasy and yellowish and they are not situated on an inflammatory base, and are limited to that region, and the scaling or crusting is diffuse and not in patches. In psoriasis the scales are usually profuse and mother-of-pearl

colored, and are situated on inflammatory bases and occur in patches which are circumscribed. Psoriasis is hardly ever confined to the scalp, other lesions being found, especially on the extensor surfaces of the knees and elbows. In the squamous syphilids it should be noted that these are rarely confined to the joints and extensors, where patches of psoriasis in children are usually seen.

The **prognosis** is favorable for the cure of the existing lesions, but as the disease is very liable to recur sooner or later, a guarded opinion as to ultimate cure must be given.

Treatment.—Internally the chief remedy is arsenic, which is of undeniable value and is well borne by children. It should not be prescribed until the acute inflammatory symptoms have subsided and while the disease is rapidly spreading. The scales should be removed before local treatment is attempted. This may be accomplished by rubbing in, with a rag, sapo viridis and hot water, or by the prolonged use of a hot-water and soda bath.

About the face and the scalp a good ointment is ammoniated mercury, twenty to forty grains to the ounce of lanolin and cosmolin. Chrysarobin is most efficacious, but should be used with caution, as it may set up a spreading dermatitis. A good application is:

℞. Chrysarobin., ... gr. x
Acid. salicylic., ... gr. xx
Liquor gutta perchæ, ... ℥j.

SIG.—Apply with a camel's-hair pencil every third or fourth day, to be followed by a bath.

Another good application is tar, one to four drams to petrolatum one ounce.

PURPURA.

Purpura consists in the development of variously sized and shaped reddish, usually nonelevated hemorrhagic patches, not disappearing under pressure. The several varieties of purpura are: (1) Purpura simplex; (2) purpura rheumatica; (3) purpura hæmorrhagica.

Purpura Simplex. — Rarely any premonitory symptoms; apparently spontaneous hemorrhages make their appearance suddenly, often during the night. They most frequently appear on the lower extremities, especially on the flexures, but Croker has observed them in children occurring first upon the neck and upper part of the back, and even in the mouth. The lesions are pin- to pea- or bean-sized and do not fade on pressure; they are usually rounded or oval, but may be irregular in shape.

Usually they are symmetric and come out in crops. At first they are bright red. This redness gradually fades to purple, bluish green, or dirty yellow (the same changes that take place in an ordinary bruise). They disappear slowly by absorption, leaving a temporary pigmentation.

The course of this variety varies from a few days to a few weeks.

Prognosis.—Good.

Treatment.—Locally none is usually required. Rest in bed is advisable for a few days.

Purpura Rheumatica (Peliosis Rheumatica).—This is, like some cases of erythema nodosum, an affection of rheumatic nature. The cutaneous lesions are secondary to the constitutional conditions underlying. The disease is usually ushered in by more or less fever, loss of appetite, depressed spirits, and severe rheumatic pains, especially about the joints of the lower extremities.

In a few days the purpuric spots appear in patches, especially in the region of the joints, in which the pain is most severe. When the eruption appears, the pain in the joint frequently abates or, it may be, entirely ceases. The patches are bright red at first, but do not fade on pressure. They disappear, as in purpura simplex, changing color, becoming purplish, etc., as in a bruise. This disease usually occurs in middle age, but it is not unknown in children. It can hardly be confounded with any other disease, as the combination of pain in the joints with cutaneous hemorrhages makes the diagnosis clear.

Cardiac trouble may arise in the course of this disease and may become permanent.

The *prognosis* for uncomplicated cases is good. If grave complications are present, a guarded one is to be given.

Treatment.—Rest in bed. Getting up too soon may cause a recurrence of the hemorrhages and pains. Salicylates are indicated and should be pushed. Quinin, iron, and a liberal diet should be prescribed, and strict attention must be paid to the hygiene.

Purpura Hæmorrhagica (land scurvy) may develop from purpura simplex, and it may be regarded as a severe and exaggerated case of the same. Usually premonitory symptoms of a decided character usher in this affection—headache, general debility, and even convulsions (Crocker). The spots generally appear suddenly on limbs; the mucous membranes are also involved—mouth, nose, bladder, vagina, etc. These hemorrhages may be so profuse as to lead to exhaustion or death, or, on the

other hand, they may be moderate. They may continue for a few weeks or so, or gradually cease altogether.

This type of purpura is usually seen in debilitated subjects or in those in a depraved state of health.

Treatment.—Enforce absolute rest in bed; sustain the strength by nourishing and easily assimilable diet. Ice internally and externally may be useful. Calcium chlorid, owing to its property of increasing the coagulability of the blood, has lately been highly recommended in doses of from ten to twenty grains thrice daily.

SCABIES.

Synonym.—The Itch.

Scabies is a contagious parasitic disease, due to the acarus scabeii, characterized by a multiform eruption of a *peculiar distribution* and the presence of cuniculi, or burrows, which, if found, are pathognomonic. The depredations are wrought by the female, who burrows just below the surface of the skin, deposits feces and eggs, and there dwells. As soon as the young are hatched they start out energetically likewise to burrow. These burrows are seen as zigzag or straight dotted linear elevations of the epidermis, and are found between and on the sides of the fingers and on the flexure surface of the wrist; also on the penis in males.

As the mite seeks warm, moist, and protected places for its habitat, this disease therefore has its own peculiar distribution, viz.—between the fingers, on the flexor surfaces of the wrists, anterior folds of the axillæ, and on the abdomen and buttocks. Except in infants and young children, the face and scalp are free.

The **diagnosis** is usually easily made from the history of contagion often given, the peculiar distribution of the dermatitis, the multiformity of the lesions (burrows, vesicles, papules, pustules, scratch-marks, and blood crusts), the marked itching, especially at night, and, except in infants, the freedom of the scalp and face from invasion. In children the burrows are usually readily found, and when seen, they are pathognomonic.

Treatment.—The itch itself is not difficult to cure, but the resulting eczema or dermatitis may be troublesome. Too little treatment, on the one hand, and too much or too vigorous, on the other, is to be deprecated. (For the dermatitis resulting from the irritating application see Eczema and its treatment.)

The first thing to do is to give the child a thorough bath in hot water and soap, to soften the epidermis and open up the bur-

rows, and then apply the following ointment every night for four nights, rubbing in thoroughly from head to feet:

℞. Sulph. præcip.,
Bals. peruv., ... aa ʒj
Petrolat., ... ℥j.

Or:

℞. Beta-naphthol, ... ʒss–j
Unguentum adipis, ... ℥j.

On the next night following the fourth application give another bath, to remove the ointment, débris, etc. Allow the patient then to go without any applications for three or four days, as a dermatitis may have been set up from the irritating parasiticides. This will then subside in a few days. The disease may not have been cured, or some of the mites may have escaped; if so, a second course of treatment for four days will almost certainly cure the disease.

In young infants the remedies outlined above may be too irritating, hence styrax is to be used, pursued as directed for the older children:

℞. Styracis liq., ... ʒj
Ol. olivæ, ... ʒij.
Sig.—Apply at night for two or three nights.

SEBORRHEA.

Seborrhea is a functional disease of the sebaceous glands of the skin, characterized by an increase in the amount of sebum poured out or an alteration in its quality, in the form of oily, scaly, or crusted material. There are two varieties, seborrhœa oleosa and seborrhœa sicca.

Seborrhœa oleosa appears in the form of a greasy coating on the skin, most commonly on the scalp and face.

If the vernix caseosa of the new-born continues, it may pass into seborrhea, and this, if neglected, may run into an eczema. Smegma of the genitals is a form of the same disorder, and if excessive or unremoved, it produces considerable discomfort and perhaps balanoposthitis. The treatment of seborrhea is both constitutional and local, those suffering from the disorder being usually in a depraved state of health. After infancy it is most likely to appear about the time of puberty. Functional disorders should be attended to and nutrition kept at a high plane. The local treatment consists of removing the scales and crusts. The best application is salicylic acid 15 grains, petrolatum one ounce,

left on over night, and then wash with hot water and Castile soap.

Sulphur is the most reliable remedy for seborrhea—one dram to one ounce of petrolatum in an ointment rubbed into the scalp. The German superfatty sulphur salicylic soaps form an elegant mode of applying sulphur to the scalp. They can now be had in most drug shops.

The vegetable parasitic diseases most commonly met with in childhood are ringworm and tinea favosa. Tinea versicolor occurs so rarely that no consideration need be taken of that affection.

TINEA TRICHOPHYTINA.

Synonyms.—TINEA TRICHOPHYTINA TONSURANS; RINGWORM OF THE SCALP.

Ringworm occurs in the scalp up to the age of sixteen; after that the disease is practically unknown to infect this region.

Ringworm occurring in the scalp is not a trivial variety, like ringworm of the nonhairy portion. It is a stubborn and serious disease, frequently resisting for months, and sometimes years, the most persistent and intelligent treatment.

The **diagnosis** is usually made without any difficulty, but we have so frequently seen instances where the treatment prescribed in new cases has been poorly adapted, or perhaps so improperly carried out that these incipient cases, instead of being cured in a few weeks or months, have run on from bad to worse and lasted for years. These children spread the disease right and left, and inoculate others in the same family, institution, or school, or, perhaps, the whole neighborhood. Instead, had persistent and vigorous treatment been instituted and carried out from the very beginning, the disease would have, it may be, been readily cured in a comparatively short time and have prevented the inoculation of others. Therefore, be it remembered, that no case of ringworm of the scalp should ever be slighted or made light of to the family or attendants.

Etiology.—The cause of ringworm is found in the growth and development of a parasite or fungus. Until recently the trichophyton fungus was supposed to be the sole cause of this affection. Sabouraud, and others following him, have differentiated three great varieties, two of which are trichophytic, and a third a different species, viz.—microsporon audouinii. A full description of these several varieties may be found in the latest editions of the dermatologic works. The disease is very con-

tagious, is very common, and is met with everywhere. Ringworm of the scalp is a disease of childhood, and is seldom seen after puberty. The disease is usually contracted from the lower animals, or from child to child through the medium of hats, caps, brushes, towels, wearing apparel, etc.

Symptoms.—Tinea tonsurans begins as a small, scaly, reddish spot, which grows peripherally from day to day. The epidermis, the hair, and the hair follicles become invaded by the fungus and a patch forms on the surface, which is rounded or irregular in shape, and varies in size from a pea to a dime or to a quarter-dollar or larger. The patch is circumscribed and partially bald. The hairs are lusterless, dry, broken off, twisted, bent, or fallen out. The follicles are prominent and have a "goose-skin" or "plucked-fowl" appearance. The larger patches are pale or grayish red, and distinctly thickened and scaly.

Itching is variable—it may or may not be present.

Microscopic Examination.—Select a few hairs from the edge of the patch—the lighter the color of the hair, the more readily the fungus, as a rule, may be found. Wash the hairs first with ether, to remove any oil or grease, place in a watch crystal, and soak for twenty or thirty minutes in liquor potassæ, place on a slide, and gently press out under a cover-glass. Examine with 200 or 300 power diameter; the mycelium and spores are usually well defined.

Tinea Kerion.—This is an inflammatory, suppurative form of tinea tonsurans, characterized by edema, inflammation of a subacute type, and exudation of a viscid yellowish secretion from the openings of the hair follicles. The disease is deep seated.

Tumefaction may be present, and the tumors be cherry- to egg-sized. The patches are tender and painful, and fluctuation is often marked. These tumors should never be opened surgically. The hairs in the follicles are loosened by suppuration and are easily pulled out, or eventually fall out. This variety of disease frequently results in a natural cure. Sloughing never occurs. In severe cases permanent baldness may follow.

Treatment.—Crocker says: "There is only one remedy, viz.—perseverance." Parents and attendants should be made to comprehend how rebellious this disease is to treatment. Children with ringworm should not be allowed to attend school.

First, the hair should be closely cut for an inch around the patch; or, better still, the head shaved. Every third or fourth day pluck out with the fingers or forceps any loose or diseased hairs. The numerous stimulating parasiticides should be applied carefully to the patches and for an inch around the borders, and

should be thoroughly rubbed into the tissues, as deeply as possible. If an ointment has been used, first clean the scalp with turpentine to remove the old grease. Wash the scalp every day thoroughly with ordinary soap, or, better still, soft soap or tincture of soft soap. The several remedies which have done the most good in our hands are: Ointments of precipitated sulphur, one dram to one ounce; beta-naphthol, one dram to one ounce; tar ointment, either alone or combined with the above; corrosive sublimate, 1 : 500 in solution, or two to four grains to ounce of ointment where not too large an area is involved; chrysarobin, ten to thirty grains to one ounce ointment. Care should be used with this last remedy, as a spreading dermatitis may be set up.

Prognosis.—A guarded prognosis should always be given—the disease often proving rebellious to treatment; months often are required to effect a cure.

TINEA CIRCINATA.

Synonym.—RINGWORM OF THE BODY.

Ringworm of the nonhairy surface as it occurs in children is very amenable to treatment, and may even run its course, terminating in spontaneous recovery. But should the fungus find its way into the hair follicles of the scalp, as frequently happens, the case is quite different. Usually the disease begins as a small, reddish, rounded, scaly spot, growing from day to day by spreading at the periphery, and a patch forms which is more or less circular, slightly elevated, and inflamed, covered with grayish, scanty, adherent scales. The margins are sharply defined against the sound adjacent skin, and slight vesication or small papules may be present on the circumference of the patches. These patches tend to clear in the center and to spread on the periphery, assuming a ring shape; hence the name "ringworm." Several rings may coalesce, and the patches may assume several varieties of shape, viz.—oval, semicircular, or serpiginous. The patches of ringworm may be in size from that of a pea to that of a half-dollar, and in color may vary from pale to bright or dull red. In children the lesions are usually unsymmetric, and the subjective symptoms slight or absent. Under the microscope the scrapings from a patch, placed on a glass slide, adding a drop of liquor potassæ, and covering with thin glass and pressing down gently, will usually reveal mycelium and spores. Tinea circinata may be

mistaken for an eczema, but the history of contagion, the course and development of the sharply marginal annular, slightly scaly patches, tending to clear in the center, and, finally, the microscopic findings, will usually make the diagnosis clear.

Treatment.—In children local treatment alone, and remedies of a simple character, as a rule, will suffice to effect a cure. Wash the patches with soft soap and water, afterward applying a solution of sodium hyposulphite one dram, water one fluidounce; or corrosive sublimate, 1 : 1000 solution; or, in ointment form, one to two grains to one ounce of petrolatum; or precipitated sulphur ½ dram to two drams to one ounce of ointment of rose-water.

As the disease is superficially seated, and therefore usually readily cured, care should be taken to select as nonirritating a remedy as possible, that the skin in children be not irritated too much, as an eczematous condition may be set up. Always apply the remedies carefully to and around the spreading borders of the patches.

TINEA FAVOSA.

Tinea favosa is a contagious vegetable parasitic disease due to the achorion schoenleinii, characterized by discrete or confluent, splitpea-sized, circular, cup-shaped, pale-yellow, friable crusts, commonly perforated by a hair.

The seat of this disease is usually in the scalp, although the general surface of the body and the nails may also be involved. The disease is fortunately extremely rare in American-born children, but is not uncommon in Russian, Italian, and Polish children, and is rarely encountered in any but the lower classes. Its customary seat is the scalp, but other portions of the skin, even the mucous membrane, may be invaded.

On the scalp the disease appears first as a small, sulphur-yellow disc, called a "favus cup," imbedded in the epidermis and seated about the hair follicles. They consist of almost pure fungus, and these crusts are splitpea-sized, dry, friable, and sulphur yellow in color, unless the hue has been masked by extraneous matter or blood or pus. They are seated superficially, and may be raised from the underlying skin. The skin beneath is depressed, smooth, shiny, atrophied, or perhaps suppurating, hence the disease leads to atrophy of the follicle and to loss of tissue and scarring, permanent baldness, therefore, following in some cases. The hairs are invaded with the fungus, and are dry, brittle, and split. If the disease is somewhat extensive, the peculiar "mousey odor" may be noticeable.

Microscopic Examination.—Take some of the crust and examine the same way as in ringworm. The mycelium and spores are readily detected.

The course of the disease is chronic, often lasting years, and relapses are common; therefore a guarded prognosis should be given.

Treatment.—Remove the crusts aseptically; depilate; and rub in thoroughly parasiticides, as in tinea tonsurans. The affected regions should be washed frequently. Sulphur, beta-naphthol, mercurials, should be applied very much as in tinea tonsurans.

URTICARIA.

Synonyms.—HIVES; NETTLE-RASH.

Urticaria is an inflammatory disease of the skin, characterized by the development of wheals, which are of various sizes and shapes, fugitive and ephemeral in character, white or reddish, accompanied by painful pricking and tingling sensations, and usually slightly elevated above the skin. On the face it may produce great disfigurement: a single part, as the lip, may become enormous. The disturbances of sensation may be merely annoying or overwhelmingly painful. The name "nettle-rash" alludes to its similarity to the sting of a nettle. The lesions may appear in almost any part of the body and shift about constantly. If the disease attacks the epiglottis, it may threaten life. The duration depends upon the persistence of the cause. The forms of urticaria are the papular, hemorrhagic, bullous, or urticaria tuberosa, or giant urticaria. It may become chronic, the lesions coming and going in repeated crops. The causes of urticaria are many and diverse—external irritants, as the stings of insects and jelly-fish, and internal causes, the secondary effects of intestinal derangement. Certain articles of food produce it in those predisposed, especially shell-fish, the sea scavengers, such as lobsters and crabs, which frequently contain unusually severe poisons acquired from the carrion on which they feed. Some berries produce it in the susceptible. Exciting causes may be sudden emotion or excitement. The treatment depends chiefly on the discovery and removal of the cause; some susceptible individuals have the disease developed within a very few minutes after tasting certain articles of food. We know a child, now twelve years old, who for years has been so sensitive to any portion of egg that to taste an article which contains this will produce, in a very few minutes, swollen lips and throat, and

if any considerable amount be swallowed, hives will develop in less than an hour. In certain cases of suspected poisoning it is wise to administer an emetic; in all cases it is better to give a purge. A saline laxative is best, as being quickest, but it is well to follow this by some thorough cleansing agent, as castor oil. Then the intestines require critical and deliberate attention. Diuretics are often of use; the alkaline mineral waters and various sorts of eliminants and intestinal antiseptics; pilocarpin by mouth or under the skin is of value. Quinin is admitted by all to be a useful remedy, for known or unknown reasons. Arsenic is often of service when all other remedies fail. Codein is an excellent quieting agent. Externally, alkaline baths are of great comfort, followed by soothing powders. Vinegar and water, alcohol and water, and carbolic acid and glycerin lotions relieve. Chloroform, a dram to the ounce of alcohol; ammonia and water, especially bran water, each have their sphere. In the subacute or chronic forms ointments act happily. (See the treatment for Eczema.)

CHAPTER XVII.

DISEASES OF THE EAR.

The more common diseases of the ear occurring in childhood will be described, and, for the better convenience of the busy practitioner, only such treatment as has proved most efficient in our hands will be given. The diseases requiring instruments of precision for their diagnosis and belonging essentially to the expert will not be dealt with.

Before considering the various forms of affections of the ear it may be well to recall a few facts of special interest in the anatomy of the ear in early life. The ear of the child, like that of the adult, is divided into—(1) The sound-conducting apparatus, which includes (*a*) the external ear, auricle, and external meatus; (*b*) the middle ear (the tympanic cavity with membrana tympani and ossicula, the Eustachian tube, and the cup-shaped cavity which is the precursor of the mastoid cells. (2) The sound-perceiving apparatus—the internal ear or labyrinth.

The external meatus of the infant is nearly as deep as that of the adult; absence of the bony canal at this stage is compensated by the presence of the fibrous membrane in which the bone is formed later. The caliber of the meatus is smaller in infancy and more than apt to be prolapsed, while its direction in the very young is often at first downward instead of upward. It is therefore often necessary, in order to obtain a good view of the fundus, to draw the auricle downward and outward, and not upward and backward as is the case in the adult ear or in that of later childhood. It may be well also to remember that the dropping of the lower jaw will sometimes enlarge the meatus.

The lining of the middle ear is continuous, through the Eustachian tube, with that of the nasopharynx, and therefore diseases of the vault of the pharynx, whether primary or secondary, are apt to be accompanied by ear symptoms. Among the anatomic factors which make diseases of the middle ear an especial menace in childhood is the suture (*sutura petroso squamosa*) which is found in the roof of the middle ear at this age, and which sometimes amounts to a dehiscence which persists

throughout life. In the new-born infant processes of connective tissue from the dura containing blood-vessels pass through this suture into the tympanic cavity. It may thus be readily seen why a hyperemia of the tympanic mucous membrane would promptly spread to the dura and cause the meningeal irritation which is so often met with in middle-ear diseases in children. The fetal tympanic cavity is filled with a gelatinous mass, some of which persists partially degenerated after birth as a yellowish-green, thick fluid containing fat and pus-corpuscles, which are usually absorbed a few weeks after birth, but which at times causes an inflammation of the tympanum and leads to the perforation of Shrapnell's membrane, which has been named the foramen of Rivinus. The lining of the tympanum in the new-born infant is remarkable for the abundance of its vessels and its general tumefaction. The mastoid antrum is the only one of the air-spaces present in the new-born.

The ears of children should be carefully examined during the progress of the exanthemata and infectious diseases, and in cases of fever where the diagnosis is doubtful, on account of the liability of throat affections to spread through the Eustachian tube to the middle ear. In these cases the onset of the disease is apt to be insidious, and unless looked for, may not be discovered until it has gone so far as to cause permanent disability. The habit of treating lightly the affections of the ear in childhood is to be deprecated. The importance of their early diagnosis and prompt treatment is realized when we consider that fully two-thirds of the ear cases which present themselves for treatment in adult life originate in childhood, and a large proportion of them might have been cleared up by a few simple treatments in their early stages.

Many people, including all classes and conditions, are apt to treat the ear diseases of childhood lightly, an idea which is encouraged by some physicians. Death has occurred in such cases from meningitis when the seriousness of the ear trouble was entirely unsuspected. Indeed, ear affections are the most common cause of leptomeningitis. Among the diseases which show a special predilection for ear involvement are scarlet fever, measles, diphtheria, typhoid fever, influenza, and syphilis.

The only instruments required for an examination of the fundus are a head mirror, a strong light, a delicate cotton-tipped probe, and possibly a speculum.

The ear troubles which occur in childhood may be classified as: I. Diseases of the external ear. II. Diseases of the middle ear. III. Diseases of the internal ear.

I. DISEASES OF THE EXTERNAL EAR.

The diseases of the skin which occur in the external ear may be of almost any variety and should be treated by the same means which are used in similar diseases occurring elsewhere.

Eczema of the auricle and vicinity is the most common of the skin diseases met with in this locality. It is most often caused by excoriating discharges from the middle ear, and will usually promptly yield to treatment after removal of the cause.

Treatment.—In obstinate chronic cases the crust should be carefully removed and the surface cleaned prior to the application of healing remedies. For this purpose green or Castile soap and water or, better, peroxid of hydrogen may be used to soak the scab, after which it can be readily removed; then the surface may be dried by a solution of nitrate of silver (sixty grains to the ounce of water), after which an ointment of the yellow oxid of mercury (two grains to the dram of petrolatum) should be carefully rubbed into the excoriated surface. In certain cases, after the cleaning process, calomel ointment, twenty grains to one ounce of petrolatum, or an ointment of zinc oxid, preceded by black wash, or ichthyol ointment, 25 per cent., may be successfully used, but most cases yield sooner or later to the treatment first outlined. Most of these cases of eczema are essentially local in character, but in some of them cod-liver oil, hypophosphites, and, in the noninflammatory type, arsenic may be indicated.

Furuncles or **boils** occur less frequently in children than in adults. The exciting cause is probably the staphylococcus pyogenes aureus and albus, which penetrate the hair follicles, and which are introduced by mechanical irritants, foreign bodies, the instillations of irritating substances, and the like. They frequently occur in one otherwise in apparently good health. They are usually situated near the orifice of the external meatus, in the cartilaginous portion. Their most prominent symptom is pain, which is most intense when they are deep seated, radiating over the whole side of the head and neck. When not deep seated, swelling may usually be easily detected by the aid of a reflected light. This is at times red or livid, and is very painful to the touch of the cotton-tipped probe. If deep seated, the pain is more marked, the swelling less so, and there is usually no change of color. Their location, however, may be determined by the aid of the probe. If anteriorly located, the region in front of the tragus may be swollen and tender, and when posteriorly located, they may simulate mastoid swelling and pain. Two

conditions which resemble furuncles in appearance are : (1) Exostoses, when covered by a red skin; (2) bulging caused by burrowing pus from the mastoid or tympanum.

Treatment.—The severe pain of furuncles is most promptly relieved by a deep incision through the tender area, which should be done with strict asepsis. The release of the tension consequent to the blood-letting will usually bring relief, even if no pus be liberated. The incision should be anointed with the official ointment of the yellow oxid of mercury, which should be gently forced into the wound. Should the furuncle be pointed, a small prick will probably bring relief without the prick itself causing any pain. The incision should be made under strong illumination, with strict asepsis, and preferably with a small knife made for this purpose. If the pain is not excessive, hot boric solution may be gently syringed into the ear or allowed to flow in from a fountain syringe at a slight elevation or from a teapot. Hot-water bags or hot salt- or hop-bags often give relief, after careful cleansing and the application of an ointment of ichthyol or the yellow oxid of mercury. So, also, hot carbolized oil or carbolized glycerin is at times grateful. The use of sweet oil and laudanum, hot raisins, tobacco-juice, and what not through the whole gamut of "household remedies" should be discouraged. Furuncles often occur in series of three or four, and it is well to forewarn those interested of this fact.

Ceruminosis.—Excess of cerumen or wax banked up in the external meatus may be caused by : (1) frequent hyperemias of this region ; (2) contraction of the meatus ; (3) improper cleaning of the external meatus by inserting the twisted corner of a wash-rag or towel or similar contrivance into the ear.

Parents and nurses should be especially warned against mechanically irritating the lining of the canal by undue cleanliness, and it should be pointed out to them that if the concha be wiped out with a soft moist rag, the canal will take care of itself, and that anything introduced into the meatus is likely to do harm and result in anything but the desired cleanliness. These plugs of epithelium and wax may be soft and yellowish, or hard and dark brown. They can be readily detected by the aid of reflected light, and may be safely and promptly removed by syringing with hot water.

Treatment.—The canal should be straightened and opened by tension on the auricle, and a stream of hot water from a syringe should be directed around the edge of the plug parallel to the direction of the canal and chiefly along the upper wall. A few syringefuls carefully directed will bring out the plug without further

manipulation. Should the mass be too hard, however, it may be softened by a few drops of water and bicarbonate of soda, added at intervals for twenty-four hours, after which it may easily be removed by syringing. Instruments should not be used forcibly for the removal of wax. The wax plug itself is practically innocuous, while clumsy instrumentation will bring about grave disturbances. After the removal of the wax the canal should be gently wiped out with cotton soaked in equal parts of peroxid of hydrogen and alcohol, then loosely plugged with aseptic cotton, and the directions given that it should be removed at bedtime and left out.

Foreign Bodies in the Ear.—These may be of any kind or shape, and may readily be detected by the use of strong reflected light. The symptoms are not usually serious, even when the foreign substance is allowed to remain in the ear over long periods of time. Cases have been reported in which beads, grains of wheat, and like substances have remained in the ear for forty to forty-five years only to be discovered by chance at the end of that time. This point should be especially borne in mind, as it is better to allow the foreign body to remain in the ear than to use severe measures for its extraction.

Treatment.—The size and shape of the foreign body, as well as its location, should be noted by the aid of reflected light; then, with a carefully directed stream of tepid water or boric acid solution, the body may be forced out of the canal. The syringe nozle should be long and narrow, so that the course of the stream may be accurately followed by the eye, and it should be so directed that it will pass the body, which will then be forced out by its return flow. This failing in the hands of one unskilled in ear manipulation, it would be well to refer the case to an expert. Clumsy manipulations of foreign bodies have brought about most disastrous results.

II. DISEASES OF THE MIDDLE EAR.

The majority of diseases of the ear occurring in childhood come under this heading, and they may be intelligently studied under four divisions—namely: (1) Acute inflammation of the middle ear; (2) acute suppurative inflammation of the middle ear; (3) chronic suppurative inflammation of the middle ear; (4) chronic catarrhal (sclerotic) inflammation of the middle ear.

1. **Acute inflammation of the middle ear** (**otitis media acuta**) and acute suppurative inflammation of the middle ear resemble each other up to a certain point in etiology, symptoms,

course, and treatment. They may, therefore, be considered together. Each may be defined as an acute inflammation of the lining membrane of the middle ear, caused by undue exposure, inflammation of the nasopharynx, foreign bodies, or other traumatisms. It may at times be superimposed upon a chronic middle-ear catarrh. Both the simple and suppurative forms are more common in children than in adults. Usually but one ear is affected at a time, although in cases of scarlatina or typhoid fever both ears are often affected. The two forms resemble each other up to the point of perforation of the membrana tympani, which determines the suppurative condition. In the suppurative condition, however, the symptoms are apt to be more aggravated. Scarlet fever is a most fertile source of middle-ear inflammation. Twenty per cent. of all chronic diseases of the middle ear originate in this disease. The onset of the ear trouble in scarlet fever is often insidious, and unless the ear is examined, even when there are no symptoms present, its course may be partly run and irreparable damage done before detection. It is interesting to note in this connection that the ear symptoms in scarlet fever are closely associated with the nephritis, and it has been held that the early cure of the kidney condition has a happy effect on the course of the ear trouble, and vice versâ. Special examination of the ear should be made from time to time as a routine procedure in scarlet fever; odor and discharge should be carefully looked for so that the danger of infection of the meninges may be guarded against. The ear is less frequently affected in measles than in scarlatina. Here, again, the ear trouble is the result of extension of the inflammation from the throat through the Eustachian tube. In measles the otitis is apt to be of milder form than in scarlet fever, but it should, nevertheless, be carefully looked to. In hereditary syphilis inflammation may spread through the Eustachian tube to the middle ear. In rheumatoid arthritis ankylosis of the ossicula may rarely occur in childhood, while in Hodgkin's disease deafness may occur from occlusion of the Eustachian orifices by adenoid enlargement. Ear diseases may be early manifested in leukemia.

Symptoms.—There may be no early symptoms or there may be a stinging, throbbing pain extending at times over the head to the teeth, usually intermitting and worse at night. In children there is frequently a tenderness over the whole external region of the ear, more especially over the region of the Eustachian tube in the neck. In the very young ear pains are frequently indicated by the patient putting the hand to the affected ear, or leaning toward the affected side; also by restlessness and irritability.

There may or may not be fever, although in the suppurative form there is apt to be a rise of temperature. Older children may complain of noises or numbness in the head and of difficulty in hearing. Examination of the fundus in this condition discloses the membrana tympani more or less injected, especially in the region of the short process and manubrium.

2. Acute Suppurative Inflammation of the Middle Ear.—In the more severe forms (suppurative forms), which lead to perforation, the entire membrana tympani is injected as well as the osseous meatus, so that it is difficult to tell the membrana tympani from the walls of the canal, as the boundaries are no longer well defined and the perspective lost, while the cartilaginous meatus is often painfully swollen, as well as the external parts and the neighboring glands. A perforation, when present, is difficult to be seen even by the expert. However, its presence may be recognized by the discharge and cessation of the severe pain. The results of middle-ear inflammation are: (*a*) Healing; (*b*) transition to the chronic form; (*c*) progression to the suppurative form, mastoiditis, meningitis, or sinus phlebitis.

Prognosis.—Generally favorable, except in the infectious cases or in weaklings.

Treatment.—This should first be directed to the nasopharyngeal condition. The nasopharynx should be thoroughly sprayed with an alkaline antiseptic solution. The Politzer bag tip should then be applied to one nostril, and the bag forcibly compressed so as to blow any remaining secretions out of the opposite nostril. The nasopharynx should then be wiped with a curved cotton-tipped applicator, which has been previously dipped in boroglycerid or dilute glycerol of tannin, and introduced through the mouth back of the soft palate. The Eustachian orifices should receive special attention in this cleansing process. The Politzer bag tip should then be applied to one nostril, the other firmly compressed, and the vapor of chloroform or iodin or simply heated air from above a lamp should be gently forced into the middle ear. In order to maintain sufficient pressure in the nasopharynx to successfully Politzerize the tympanum, the soft palate should be raised against the posterior pharyngeal wall, to accomplish which the patient should be told to puff out the cheeks or swallow a sip of water. If water is used, the bag should be compressed at the moment the pomum Adami rises. The act of crying will also serve to raise the soft palate. During the early stages this line of treatment will often immediately relieve earaches as well as deafness. This failing, a hot-water bag should be applied to the ear or a hot douche of

water or boric acid solution, long continued, may be used with gentleness. The various household remedies so often indulged in should be adjured. They embrace poultices, onion-cores, sweet oil, hot raisins, laudanum, the painting of the mastoid with tincture of iodin, or even blistering it. Poultices tend to increase the congestion; onions are surgically unclean; iodin and blistering disguise mastoid complications which may arise later. If the symptoms are severe, indicating that we have to deal with the suppurative form, a paracentesis will give relief when there is bulging of the membrane. This little operation should be done under strict asepsis and strong illumination. The most prominent point should be incised, care being taken to avoid the ossicles and due account being taken of the obliquity of the tympanic membrane. Injuries of the promontory are not apt to retard the healing process. The incision should be followed with inflation by the Politzer bag, as described above, and a hot douche, or syringing with hot water or boric acid solution, after which the canal should be dried and protected with aseptic cotton. Daily cleansing and Politzerizing should follow until suppuration ceases. Due attention should be paid to the general condition, and the indications met as in ordinary cases. The patient should be kept in a recumbent position. Should the mastoid region become puffy, boggy, red, and tender, with intermitting fever, and especially if these symptoms are accompanied with puffiness of the superior, posterior, inner wall of the meatus, opening of the mastoid is indicated. Sudden cessation of the discharge with a drop of temperature and slowing of the pulse imply that the pus has made into the cranial cavity.

3. Chronic suppurative inflammation of the middle ear may be defined as a suppurative condition of the middle ear occurring most frequently in childhood, and involving the tympanic membrane and often the external meatus, the bony walls of the middle ear, or even the labyrinth.

Causes.—The more common cause is the progression of the acute purulent otitis of childhood, especially that following scarlet fever, diphtheria, typhoid fever, and other infectious exanthematous diseases. It is frequently bilateral. It may at times develop in certain cachexiæ without the previous acute phenomena.

Symptoms and Results.—These are most various and complicated. It will be sufficient for our purpose to state these in a general way only, leaving the details to text-books devoted especially to diseases of the ear. In the very young attention is frequently first called to this disease by the discharge from the meatus or by the odor. Headaches or fullness in the head may

be present, or more rarely giddiness or vomiting; disturbances of hearing, in varying degrees, are usually present, and should there be damming up of the pus, pain is also experienced. The results of this disease are: (1) Hypertrophy of the mucous membrane; (2) hyperplasia in the form of granulations or polypi in the tympanic cavity; (3) connective-tissue formation leading to adhesion between the ossicula, membrana tympani, and walls of the tympanum; (4) destruction of the mucous membrane, membrana tympani, and, often, of the bony parts. The tympanic membrane is almost always perforated and it may be thickened. The perforation may be of any degree or shape. There may be caries or necrosis of the temporal bone or the formation of osteophytes. The secretion may vary in character and quantity, and the presence or absence of odor is not significant except as indicating the retention of secretion. There may be changes in the secretion of cerumen or cholesteatomata may be formed.

Treatment.—While the treatment varies according to the character and extent of the destruction of the parts, it may be outlined in a general way. As in the acute form, the naso-pharynx should be cleansed and the tube-mouths wiped out; then the ear should be gently wiped and dried by a tuft of aseptic cotton on a delicate applicator, following which a similar tuft dipped in peroxid of hydrogen may be gently wiped over the surface to boil loose particles of dry mucopus, epithelial scales, bony detritus, and so forth. The middle ear should be Politzerized to clear the Eustachian tube, and again wiped clean. If there is tumefaction of the mucous membrane, a solution of alcohol (50 per cent. at first, gradually increased to 95 per cent.) may be applied to it, and then again one should Politzerize, wipe dry, and dust with a small amount of boric acid by means of an insufflator. If these cases prove obstinate, aqueous solutions of silver nitrate (sixty grains to the ounce) may be substituted for the alcohol solution, or a solution of sulphate of zinc (4 per cent.), or a solution composed of alum (one dram), zinc sulphate (one dram), carbolic acid (forty grains), water (two ounces). If polypi are present, they should be snared, or they may be reduced by alcohol or chromic acid applications. Caries may indicate curetment or the removal of the ossicles, or even one of the various mastoid operations. At times the cleansing process may be aided by the use of a rarefacteur to draw the pus into the external meatus, or the Eustachian catheter may be needed the more forcibly to clear the tube or to guide various fluids—*e. g.*, boric acid solution (4 per cent.) and warm saline solution—through it. Aristol, iodoform, acetanilid, or their modifications may be substituted for the

boric powder. These cases should be cleansed every other day at first, and then, as they improve, twice weekly, once weekly, and so on, gradually increasing the intervals between treatments as recovery progresses. Internal treatment is indicated in rheumatism, syphilis, anemia, and other general diseases. Cholesteatomatous masses may be removed by means of the curet or attic syringe, or may require a mastoid operation.

4. Chronic Catarrhal (Adhesive) Inflammation of the Middle Ear.—This name has been given to those inflammations of the middle ear which give rise to sclerotic (adhesive) changes in its lining mucous membrane and lead to permanent defects of hearing. The condition may start in an exudative catarrh, or it may start insidiously as an interstitial inflammation which is progressive. The condition, after running an insidious course, usually ends in extreme hardness of hearing. Fortunately, this disease is not frequent in children, although its occurrence in after life may be precluded by the careful and timely treatment of the exudative forms of middle-ear trouble.

Causes.—(1) Chronic nasopharyngeal catarrh; (2) postdiphtheric paralysis; (3) scrofula, tuberculosis, marasmus, or anemia.

Pathology.—The pathologic changes consist in the formation of fibrous connective tissue in the mucous membrane, with shrinking (sclerosis), atrophy, and calcification of the newly formed tissue. Thus, the ossicles are bound to each other and to the walls of the tympanic cavity. The tympanic membrane may appear normal, may be thickened or atrophied, or may have chalk deposits within it. The symptoms to be looked for in children are progressive deafness, subjective noises, which latter, however, rarely annoy them, even when present, and there may be *mental dullness*, which may be the most prominent symptom.

Treatment.—Hygienic conditions should be carefully attended to, wet feet guarded against, as well as sudden cooling of the body, and cold sleeping-rooms should be avoided. The nose and nasopharynx should be placed in approximately normal condition by the removal of deformities, polypi, etc. Politzer's method or the catheter should be used to inject air, chloroform vapor, iodin vapor, or various solutions (?) into the middle ear. Gentle aural massage by means of Siegle's or Delstanche's apparatus is often indicated. The use of the Valsalva method is not advised, although automassage by pressing the finger to the tragus may be encouraged.

III. DISEASES OF THE INTERNAL EAR.

These diseases are fortunately less frequent than those of the middle ear. They are, however, relatively more frequent in children than in adults, probably for the reason that the channels of communication between the internal ear or labyrinth are more free and more numerous in the young. The causes of nerve deafness are the infectious fevers and the exanthemata, syphilis, leukocythemia, diabetes, Bright's disease, mumps, meningitis, brain-tumors, traumatism, intense sounds, as explosions and the like; extreme mental strains, such as fright, and angioneurotic congestion.

The *symptoms* may be classed as (1) irritative and (2) paralytic, and include subjective noises, hyperacuteness of hearing, dizziness, vomiting, loss of coordination, and loss of hearing. At times they develop slowly, at others the onset is sudden.

The *prognosis* is unfavorable, as a rule, though at times, as when due to syphilis, hysteria, or medicines, there may be improvement.

Treatment.—This should be directed to the general condition. Such remedies as quinin, iodid of potash, mercurials, pilocarpin, and the bromids are most commonly indicated. Quinin will increase the blood supply; bromids decrease it. Iodid of potash tends to reduce round-cell infiltration or absorb particles of inflammatory tissue. Pilocarpin in 2 or 4 per cent. watery solution is also supposed to further the absorption of round cells or of inflammatory particles.

Panotitis is a form of ear disease occurring chiefly in children,—often in the course of diphtheria or scarlet fever,—in which there is a suppurative process in both the middle ear and labyrinth, accompanied with high fever and a discharge from both ears, and terminating in deafness.

Prognosis in this disease is most unfavorable, total deafness usually resulting. The internal administration of iodid of potash or of pilocarpin may be of some benefit.

CHAPTER XVIII.

GENERAL CONSIDERATIONS ON PHYSICAL DEVELOPMENT

WITH SPECIAL REFERENCE TO CHILDREN OF FEEBLE POWERS AND LOWERED RESISTANCE.

The upbuilding and repair of all children, especially those who are weakly or convalescent, should be considered on broad principles, the basis of which is elaborate thoroughness and abundance of time. This involves special attention to dietetics, including a critical estimation of varying states and capacities of digestion, all the ordinary hygienic measures, and the hopeful use of some drugs. There must be insisted on for such, both during average health and during illness and convalescence, more rest for the mind and body than is necessary for the average child. All outings and exercises, both active and passive, should be supplemented by rest, lying down for as long a time, it may be minute for minute, as the active periods. This rest is necessary to enable lowered organic processes to regain their customary tone, and especially to secure definite gains. It will often be necessary to precede food by a period of rest, to enable the digestive activities to have full play; otherwise the highly sensitive nervous distribution to the digestive apparatus will fail of its full energizing. Mental or emotional agitation impairs the even flow of the circulation, so necessary for the best work of weakened organs, particularly the brain, whence governing impulses perpetually flow, dominating the body and spirit. Therefore, too, the emotions must in the weakly be not only kept well under control, but subjected to the least possible disturbance or exaltation. The temperaments (or mental attitudes from which they view life) of all children require steady and patient training. Even in the home a clear recognition of these is needed. In the case of strong children, equipped with clear, dominant, healthy minds, it is undoubtedly true that fair results come somehow from very diverse and ill-directed influences; but for the weaker

ones, impressionable or apathetic, thorough, conscientious study and specially directed measures are required.

For such little folk it is not enough to prescribe suitable medicines and enumerate casually a list of easily digested foods which the mother shall provide, nor to direct proper bathings, outings, and other general measures. A thorough systematization of the entire daily life of the child is infinitely more efficacious than the most accurately selected medicines or the use of that innumerable host of children's foods with which, in the form of specious descriptive circulars, the enterprising chemists flood our morning mails. The best tonic for the stomach is food carefully prepared, such as a fairly intelligent mother in even the humblest walks of life, if rightly directed, can readily afford, but always provided that the careful preparation, the times and circumstances of administration, be wisely chosen and rigidly adhered to.

Predigestion of food-stuffs offers undeniable safeguards to the weakened, toneless digestive tract, but robs the pabulum too often of that savoriness which is essential to acceptability, and hence imperils appetite.

While exercising care as to the quality and preparation of foods for weakly or convalescent children, it is imperative to bear in mind the need for suitable variety. This fact we have time and again verified. A child will often be presented who is fed with the utmost care and regularity, oftentimes under the best of medical advice, and yet its progress comes to a standstill or it is seen obviously to retrograde. Upon inquiry there will be revealed much sameness in the diet-list, otherwise properly adjusted to the condition for which it was originally outlined. The little victim's soul comes to loathe and abhor the sight of flabby paps, occurring in dismal routine, or the same old wearying round of bread, meat, and a dab of vegetables. If to these is now added a more varied dietary, revising the menu day by day, even lapsing into a taste, now and again, of articles ordinarily forbidden yet savory and tempting, great progress will soon be obvious.

The growing practice of sterilizing milk for infants and children, invaluable as this protection is for temporary use during hot weather in cities, often leaves anemia and tonelessness, even scurvy, in its train if its use is persisted in. There is a value in the vital properties of fresh milk not to be produced or retained by any artificial process.

The utmost care needs to be observed, however, first, in the quality of the milk, which includes an estimation of the health of the cow; secondly, strict regulation as to the treatment of

the milk while being collected and immediately thereafter, and, finally, the greatest conscientiousness in securing cleanliness of the containing vessels. These conditions, though difficult, are becoming more and more possible as knowledge grows, and if fulfilled, will bring a perfect article to the consumer.

The points which certainly do not obtain adequate attention are the thorough systematization of the when, where, and how much of these foods shall be taken; what *varieties* shall be insisted upon; the times, kind, and suitability of the bath; the amount and character of exercise, and, above all, definite periods of *rest* before and after feeding, so that the organs shall be able to act deliberately. First, then, when confronted with an ailing child, one who is not ill, but far from well, when appetite is variable but small, when sleep is restless, the digestive organs manifestly disturbed and temper fretful, one that fails to hold its own in play among its fellows, and, what may not be ignored, whose weekly school report shows decided backsliding—first, look the little fellow over thoroughly and in all respects.

There may not be one organ more amiss than another, though the most obvious faults will usually be seen in that avenue to all vital power, the *prima via*. There may be yet no falling off in weight, a far more instructive index in a child than in an adult, nor an obvious anemia. There may be a quicker pulse than ordinarily, a change in the heart-sounds which the initiated will recognize but can not so clearly describe; there probably will be found, if so much trouble is taken, a rise in temperature, slight but unmistakable at times, at others subnormality well marked, and there is great probability that neither the attention nor other exertion is readily sustained. The child, in marked contrast to its healthy comrades and itself at other times, is willing to sit aimlessly, if not a martyr to energetic task-masters or to an overstrenuous conscience which drives its willing victim to the verge of perpetual exhaustion, and often over it into the pit of complete collapse.

Such cases as here pictured are common enough, if only the eyes are open to see them. They escape attention only too readily until some malady seizes them in all their pitiable weakness, and life is speedily quenched. It is a worthy quest, then, to seek out and rescue these from, it may be, no picturesque fate, but an everpresent menace; to rehabilitate these unresilient little bodies and even make them better than before; to put them in the way of a sound bodily equipment for their life-work anon.

Here is a sketch of modified rest treatment which produces excellent results when all other efforts have failed to start a child

along the line of progress. Put the little one in bed from a few days to a week or more, and write down distinctly for the mother a strict schedule, giving the exact hours for feeding. These may be the ordinary three meals, with some little fluid food taken in between times, or, better, direct four meals to be given in the day, at, say, seven, twelve, four, and eight o'clock, the largest meal at noon. Omit the tonics hitherto given and add digestive ferments or malt, or both. Let the day begin with a sponge-bath in a warm room; then a light breakfast, daintily served. In the early afternoon let some one rub into the trunk and limbs an oil; olive oil will do and much of it is thus absorbed, especially if one-third part soap liniment is added, which probably aids the osmotic action. Lanolin, diluted, is best of all; changes are desirable in all skin applications. This serves as a form of passive exercise and also as a nutriment, or at least as a tonic to the skin, circulation, and cutaneous nerves. The surface should be thoroughly wiped off afterward, that no foulness remain. We have seen children immensely benefited, even among the poorest dispensary cases, from this one measure alone. Above all, in the early course of these measures, if the child manifests a desire for toys, they may be allowed sparingly, but aggressive entertainment by overofficious persons is a harm and an offense and should be strictly forbidden. After a few days or a week the range of one sunny room may be permitted, but still the child should be let alone, and in most cases it will be happy and amuse itself.

Frail children require systematic development of their various organs, as well as of their muscles. To be sure, it seems scarcely practicable to increase the power of some organs, as the stomach or kidney; nevertheless it is possible to do so. It is abundantly obvious that the eye and the lungs and the skin can be developed, and it is equally important that all these organs should receive attention in the aggregate and separately, especially where there is a manifest underdevelopment of the one or the other, which then should receive specific attention.

To take, first, the eye. An infant can sustain very considerable damage to its eye by objectionable exposure to light, which may be too strong, too sudden, or too constant. It may readily have its eye muscles disturbed by a habitual attitude, as when, by reason of a weak back or other disability, it is confined to a single place, as a chair, in a customary situation in the same room, straining vision in one way, and many other objectionable practices which common sense and observation will make evident. By the same token this eye or pair of eyes may become devel-

oped, not only in their organic capacities, in the judging of distances, inviting refractive adjustments, etc., but, as intelligence increases, great good can be accomplished by a thoughtful use of interesting objects which may excite the child's wholesome interest and educate its perception.

There are experiments now afoot, at least promising well, by which children can be taught so to perceive differences of color, in form, and the arrangement of objects, as will greatly facilitate their comprehension of natural phenomena. It is quite possible that along this line may be found means to prevent defects of sight, such as color-blindness, as well as to check the progress of myopia and other refractive errors. There is great unwisdom in submitting babies to rapid journeys, and looking out of windows at swiftly passing objects while flying along. We have seen migraine apparently develop through the custom of giving small children long exercise in a carriage with a pair of fast horses every day. We have certainly seen instances of profound disturbance caused by this means, and it is reasonable to infer that a continuance of such objectionable measures may produce lasting damage upon so delicate an organ as the eye, and the whole sensitive organism is thus imperiled.

The custom of encouraging a child to sleep while being driven about is unwise. The motion is both tiresomely regular and subject to sudden irregularities. The persistence of one kind of motion up and down is bad, not only producing relatively unsound sleep, but keeping up a molecular agitation throughout which has little to recommend it. If the infant is awake and sufficiently old and alert to sit up and look about, or to be forcibly held by the nurse in an upright position, a strain is put upon the spinal column. Thus continuous mild concussions are administered to the spinal cord and brain; thus the eye is put upon the strain, reacting directly upon the brain; an element of excitement is introduced, and physiologic irritability is a probable result.

The heart is capable of much improvement, and demands the closest attention to varying states. If a baby starts out with an organically sound heart and succeeds in getting its whole mechanism so developed (by living under wholesome conditions, which involves some systematic training, whether this come by design or accident) as to steadily increase its vigor and competence, then the heart will be the very foundation of future power and the ground of reliance when illness or strains come. It will serve valiantly to the end of great age, spent under manifold exigencies, both physical and mental. In the repair of damaged

hearts mental rest is of more importance than physical inactivity. Moreover, there are more perilous cardiac states than valvular diseases, though they may not be so demonstrable. Judicious attention to a weak or damaged heart can accomplish much and is best afforded in the line of regulated activities.

The development of the skin is of paramount importance in the young, as upon its capacity to endure changes in temperature and other states will depend much of the future healthfulness of the individual. Some children have the layers of the skin unformed from the first, and it never acquires normal activity. There is quite a large variety of skins obviously different to observant persons—the firm, glossy, velvety skin of health, the pallid, flabby, or leaky skin, readily becoming overmoist, loosely attached and wrinkling readily, or the yellow, harsh skin, either flabby and toneless, or stiff and inelastic, adhering to the bone, or seeming to do so. Some skins are insensitive and react to almost no stimulant; others chafe and get out of order if only thin clothing press upon them, hypersensitive to the simplest hurtful agencies.

The skin of a red-haired child is always tender and usually beautiful. Children predisposed to tuberculosis or scrofulosis have poor skins, which can be and should be immediately improved. Various neuroses show in the skin. In short, the surface of the body is of vast activity, and the cultivation of this large part of the organism is of critical importance.

Now, as to the means of improvement in our control. We believe if babies were anointed from the first with oil, and cleansed by rubbing them off, not using water, or but sparingly, for weeks or months, their skins would become more vigorous than when soap and water are freely used. This we have proved by a series of cases observed (and published), three of whom were our own offspring. Exposure of the skins of infants to the air of an equably heated room is wholesome, and they are better for as much exposure as possible, always short of chills. In America we are subject to such sudden and extreme changes that we dare not allow this so freely as is safe in many other countries. The exposure of knees and shoulders in children not the most robust is dangerous, unless carefully watched and promptly covered at the approach of chilling conditions. Indoors it is of use, outdoors not to be recommended at all. To go barefoot is wholesome for many. Almost never do children hurt their feet, and thus only are the feet symmetrically developed. They do not increase in size seriously. We know of

numbers of Southern girls with feet entirely beautiful who ran barefoot in warm weather until they were almost grown.

Cautious and repeated exposures induce an increasing tolerance of the skin which will greatly strengthen the whole organism. The clothing at no time should be any more than is necessary to protect. Overswathing lessens energy; it throws the volatile elements of excretion back into the blood and thus directly poisons. The skin should be able to throw away entirely and promptly its effluvia, which should be offered free escape, or its retention may damage the lungs or kidneys. When we bear in mind the capacity of the surface blood-vessels, and how greatly vascular dilatation or contraction alters the state of the varying blood supply to internal organs, also how large is the amount of matter excreted by the skin, and many other points involved in its functional activities, we at once recognize the importance of preserving its integrity at all times. If these activities are anatomically undeveloped or functionally impaired, they demand our closest attention. Natural means are best, judiciously controlled. Exposure is important, always with caution. Bathing should be frequent,—daily, indeed, or in hot weather oftener,—in as cool water as can be enjoyed or well endured, but gradually lowered if unaccustomed. Bathing should be followed by thorough drying and rubbing and prompt covering; weakly folk should lie down for a time after. If chilled, let them get into bed for a time until complete reaction comes or fatigue goes. When bathing can not be so well endured, at least as often as may be indicated, then a dry rub will suffice, especially after exertion and exceptional opening of the pores. If all this tires the child, it should lie down, and the work be done for him by another person. Soaps are to be used sparingly and only for cleansing. Salt is almost as cleansing and more stimulating. If the skin is tender, bran decoctions added to the bath will soothe. Ammonia or sulphur added to the water has value, rendering it soft and exerting special effects. To begin cold bathing, let one unaccustomed stand in three inches of warm water and be sponged off in cool and cooler water. The custom of the Greeks to exercise naked anointed with oils has much to commend it. The rolling in the sand of the arena in wrestling was accredited with benefit, and no doubt rightly. Wading at the seashore and digging in the sand is analogous, and much to be commended if not too prolonged. Swimming comes next to bathing, and is among the finest agencies for invigoration of skin and muscles. Remaining in the water longer than half an hour is of doubtful value, and over an hour is a strain, and for several hours is hurtful to any

but the strongest, and does them no good. Water colder than the air of the bath-room is often hurtful for the strongest and of little or no value to any. Shower-baths and needle-baths are terrifying to most children, and possess no advantage over sponging or plunging. It is best for little folk to encourage cool bathing by gentle gradations, and to make of it a reward or frolic. The air of the bath-room should be warm.

The exercise of the lungs next to the skin requires much attention. First, it is necessary to make sure that the avenues to the lungs—the nose and throat—shall be clean and healthy. Upon proper lung action depends the aëration and purity of the blood, and through these the complete activity of the remotest organ. Upon the integrity of the epithelium of the respiratory passages depends in great measure the defense of the organism against the onslaughts of many microbic poisons.

The nose and nasopharynx must be kept free from irritations and pathologic changes, which might limit function or obstruct the in-and-out go of the air. Upon the competence of the lung expansion will depend the completeness of the oxygenation and the competence of especially those portions of the lung which are less liable to a full distention, as the apices, so rarely developed and so vulnerable, and also the lower borders. The development of the lungs, of course, is more commonly obtained through normal activities, but if, for any reason, these are impaired—as, for instance, lameness, an enfeebled or damaged heart, or a weak, nervous organization—and the child is not able, or it may be unwilling, or, at least, indisposed, to take wholesome action and exercises, then it is essential not to lose sight of the necessity of getting these lungs sufficiently dilated by regulated exercises for their proper growth and the continuance of their integrity. For feeble children it is convenient to induce them to play at certain games which may involve deep respirations and forcible blowings. Indeed, one of the first accomplishments to teach a child is to blow its nose properly. Pretty much every child in America inherits or may develop a condition of nasopharyngeal catarrh. Among the Greeks it was considered a degradation to be obliged to blow the nose, and a most impolite thing to do; but the reason for that was their perfect health, and a large part of this was the magnificent attention their skins received throughout their earlier and later years.

All children will almost invariably acquire occasional catarrhs, and they should be early taught to free the nose of morbid or excessive secretions. The way to do this is to teach them to

blow a long, steady blast, holding the handkerchief against one nostril the while, and then, holding the opposite nostril, to take a long inspiration, and then to blow steadily out of the other one. And then, if not free, to repeat the process on alternate sides, at least twice, but never explosively. Then the air comes and goes freely, as it should, to the lungs, suitably warmed and screened.

Hearing also needs attention in the same way. As is well known, those children who habitually hear good music have this sense perception better developed. The sense of smell, while deserving of attention, is rather more likely to be over-developed to the point of squeamishness than to suffer any lack in this direction, seeing that in the evolution of the race the nose is of clearly less use than in the savage state.

In the matter of taste this merely need be alluded to. It warrants attention, but rather on esthetic than practical grounds.

Forms of Exercises and Outings.—Every element of excitement, not forgetting oversolicitous attention and forced amusements, should be deprecated and avoided until children acquire genuine vigor. Excitable children need to be watched with the utmost care, and the element of strain, wherever detected, should be sedulously removed. For very young babies merely keeping them in the open air is of great value. They should be sufficiently clothed, but not suffocated. The rule should be just enough and of the right kind, but not one bit too much; reserve overclothing to be near at hand always. In bitter-cold weather veils are of great importance, always of sufficiently open mesh for the air to get readily through, but to protect from the rougher winds. This veil, upon occasion, may be doubled, and had better be of dark color and natural tint. For the poor, a piece of cheese-cloth will suffice. Veils should be washed or at least cleansed frequently, as a great deal of objectionable matter, both from the expired air and from floating dust, may accumulate upon them and be inbreathed again.

There is a prejudice against a baby or a child sleeping in the open air. If, however, it is sufficiently wrapped up, no harm can result. During sleep relaxation occurs, especially with children of tender, leaky skins, and surface chills may arise, but these need not occur if precautions are used. A valuable form of exercise and an adequate outing are had by allowing a child from three to five years old to play about in a room with the windows wide open, and with its usual extra clothing on, such as is worn when taking its ordinary walks abroad. This form of outing can be enjoyed anywhere, at any time, for any given

length of time, and the perfection with which it may be controlled is of the greatest advantage. Furthermore, by these means the caretaker watching may remain with the child and utilize the time by pursuing some employment in useful fashion the while. An apathetic little one, who without constant urging will quietly sit down and do nothing, may be kept busy or amused; and *per contra*, a rustling, bustling little one, who would readily overdo, may be thus held in check.

Children of weak lungs or insufficient lung expansion or with a predisposition to phthisis may be taught regulated breathings to great advantage. A useful measure also is to institute for these some games, such as blowing through a tube, as shooting of peas through a tube at a mark—a very practical means of increasing thoracic size and lung power. An excellent indoor game is the old-fashioned bean-bag, at which the nurse can be a companion, and thus a perfect regulation can be established of the amount of energies employed. This bag of beans may be tossed back and forth so many times, and at different distances, increasing them from day to day and week to week. Both hands may at first be used, and, later on, as strength grows, the one hand or the other, not neglecting either. Both the right hand and the left may thus have their adequate employment, and even for stronger children this is of excellent utility.

The next step in this direction is the use of the medicine ball, which in our larger gymnasia has become quite the fashion. This so-called "medicine ball" is merely a sphere, made up of soft material, weighing from one to six or seven pounds, and covered with soft leather, the rough surface out. For little children it may be about the size of an orange, or preferably a little larger, as being convenient to hold in two hands. This, passed or tossed from one to another, requires more skill than the bean-bag, and may be used in the same way that a foot-ball is thrown and caught, either with two hands or one hand, and soon a very large measure of skill is acquired and interest incited. When the regulation or prescribed amount of passing has been done, then it can be stopped for one or all the players. A watchful caretaker may learn this amount for himself or herself, or act under specific instruction as what to do and what not to do.

The most important element in all games is the incentive of competition, even if that competition be with one's own self. In all those exercises which are devised for the purpose of keeping up a consistent interest a much larger amount of activity may be used, and with less reactionary fatigue than with any form of

exercise which fails of this quality, no matter how eagerly one may pursue it as a measure. The converse point is, however, that vivid interest may cause a weakly person to do too much, even when he is endeavoring to execute some act with skill in which he himself is the only competitor. When, however, the competition is with others, the element of excitement is added, which may become harmful to those insufficiently strong. Of games, many of the larger competitive kinds are manifestly unfit for children not overstrong. Match games of foot-ball, or even base-ball, are out of the question. Milder competitions, as in shinny or rowing, are of doubtful value; but golf is a perfect game, and can be regulated for the feeble and the strong, the young and the old, of either sex.

The evidences of overexercise in children or in weakly persons must be carefully noted. Mere breathlessness is no objection, and is easily recovered from if the organs are sound. Also, a pretty free sweating is harmless enough unless this goes to the point of saturating the underclothing, hence exposing one to secondary chill. If, however, with very small exertion sweating comes readily, and, instead of being accompanied by a normal reddening of the surface and the face, the person becomes pallid or bluish and loses the normal luster or brightness of the eye, then caution must be observed. If after small exertion there is seen a sort of trembling of the limbs, the face, and the lips, this means that enough has then been done, and possibly too much. If seen habitually in the same individual, the amount of exercise must be limited until by slow degrees and through other means adequate strength is acquired. Soreness in the muscles afterward is of no gravity, though often a source of anxiety.

It is a good point to note the face, whether it be ruddy, pallid, or bluish, as an indication of benefit or harm from exercise; not that it is infallible, because some powerful athletes, men of greatest endurance, become pale while in action. This is, however, unusual. The pulse is a useful indicator, too, and while, of course, even the most vigorous people who are in moderate condition have their heart action immensely accelerated under sustained exertion, nevertheless this excessive rapidity and loss of force usually mark the limit of their capacity, and the effort must not be kept up too long, as under excitement. If the person is in good condition, he is likely to have a full, strong pulse, only a little quickened over his ordinary rate.

We have repeatedly examined the pulse and heart of boys under varying strains, such as a prolonged foot-ball game or base-ball match, in which there was pretty constant action, and have

noted that the condition of the pulse in those otherwise in equal condition varied very much with their excitability. And inasmuch as this excitability of the person reflected upon the pulse means rapid using-up of pabulum and rapid oxidization, along with wear and tear of the nerve and other cells, therefore it is fair to assume that the rapidity of the pulse is a good indication of the using-up of vigor. If the strain on the heart is too severe, the result will be a proportionate exhaustion. The tissues of young folk are so clean and elastic that an excess of intravascular pressure can exert less harm than in the case of adults. The heart not only needs to be of proper size, shape, and tissue competence to fit the body, but the tension in the arteries and the quality of its venous competence may be ample or lacking; when this is below par, the heart acts irregularly and laboriously, and is easily wearied and its force soon spent. This is shown in dyspnea and palpitation, "air hunger," "besoin de respirer"; if long continued, the result is cardiac asthma. This phenomenon is frequently observed in the healthy under customary exertion; it is then chiefly due to the normal phenomena of insufficient elimination of the products of tissue waste, and is comfortably met by a few minutes' deep breathing or ample oxygenation, and most economically lying flat on the back, arms and legs outstretched, the head retracted and the mouth open.

For children younger or older the very best form of outing is to potter about a large garden, doing a little here and there and then resting a while. The acts involved in gardening, the digging and pruning and various forms of activity essential thereto, are by far the healthiest forms of exertion known to man. Indeed, the age of gardeners is unusually prolonged, provided they live wholesomely conditioned lives otherwise. Farm-work is a different matter, involving greater strains. But the work of the garden, under intelligent supervision or advice, which is followed, is suitable for young or old, and is of the largest possible utility.

For girls or feebler boys the cultivation of flowers in boxes, or window-gardening, is a healthful occupation. The care of small animals or of fish, as of birds or small four-legged pets, the making and caring for aquaria and such-like things, are excellent as sustaining interest and supplying some form of activity and variety without strain. The study of botany and field botanizing are among the best.

The study of birds in their natural haunts—watching their conduct, listening to and recording their songs, keeping the eyes upon their movements, especially with a field-glass—is of infinite

interest. So, also, of the woodland moving things, not neglecting even ants and spiders, although using all due precautions in approaching the latter.

For older boys, even of the sickliest, provided they have the use of their limbs and reasonable integrity of their organs, there is no one form of life which so largely conduces to the building up of nervous force and muscular vigor as camping out in the woods. There is so much to be said on this subject—right sort of camp protection and varying conditions—that it is only possible to allude to it with the statement that our experience has been fairly large, admitting of an expression of opinion, though few rules can be formulated short of a long essay.

The life of a boy under, of course, proper control in the woods, far away from civilization, is as near as possible to perfection, to the vitalizing influences of aboriginal nature. He is freest there from all those minor and major disturbing influences, excitements, artificial restrictions, or spontaneity which permits of healthy growth, mental and physical, encourages symmetry, and fortifies against warpings.

We have advised this life for a boy not ill, but still far from strong, about whom it was most natural to be gravely apprehensive lest the experiment should fail or prove disastrous; nevertheless, without himself being at first particularly pleased with the experience, this camp-life succeeded in accomplishing what no other combinations had been able to do, even of the most carefully selected or expensive kinds. The irregularity of feeding, lack of sleeping comforts, the loss of various civilized necessities notwithstanding were offset with best effect by the simplicity of life; the element of independence of little things ordinarily provided and thought to be needful; the absolute naturalness of motions and attitudes and things done; the early hours to bed and even earlier to rise; the constant breathing of perfect air, whether by night or day, wet or dry, it mattered not, and many other points too numerous to mention, produced a result most satisfactory. When in doubt, it is always well to resort hopefully and fearlessly to such conditions.

Morals and religion in these surroundings need little teaching,—a hint will suffice, and this, to the narrowed mental horizon of a young person, is a vastly important point,—and nowhere better than in the woods or wilds. Confusion is usually produced in the concepts by special or didactic ethic teaching, and it is a much worse thing than ignorance, which is a clear field for the intuitional understanding.

Development of Muscles.—There is still an impression pre-

vailing among even the best teachers of physical culture that development of the muscles exerts of itself a particularly valuable influence upon the general constitutional vigor. A good deal of attention is directed by writers on this subject, and to various means of cultivating muscular power. This is true only to a very moderate extent. To be sure, the exercising of the muscles can scarcely be carried on independently of certain collateral co-ordinative acts involving the healthy energizing of the vital organs. By quickening their activity by that of the circulation and stimulating the ebb and flow of the blood throughout the motor mechanism this does improve nutrition, and, to a certain degree, enhances generally the vigor and power of the whole economy. Exercising the muscles in vigorous persons with sound and competent organs adds to the usefulness of the trunk and limbs, enlarges their capacities, and is of permanent value. In the class of cases under discussion this is also true, but with many important modifications. The heart may be thus hypertrophied or weak spots unduly strained. The most important condition of the muscles, voluntary and other, which can be attained, is *a well-balanced elasticity.*

Let us review for a moment the different kinds of muscular actions, their mechanism and physiology. There are the voluntary and the involuntary muscles; ordinarily only the former are considered under the subject of exercise. The effect upon the involuntary muscles is a very important one, however, and precedes and should proceed *pari passu* with the stimulation of the voluntary mechanism. It is conceivable—and, indeed, we have seen instances which illustrated this—where individuals have acquired a species of muscular monstrosity by having their voluntary muscles so exercised as to increase their size and power out of all proportion to the organic capacity of the individual. This produces an overgrowth of a kind which is not only almost valueless, but a distinct menace and an evil example. In the exercise of the limbs we may divide the kinds of energy into those of swiftness or speed and of power, which may be again divided into the combination of both swiftness and power. In acts of muscular swiftness we have a very intimate connection between the motor center and the muscular mechanism, in which the center is more exercised than the limbs in proportion as we try to produce accuracy of movement with suddenness. In any muscular action involving mere power—as, for example, lifting a dead-weight—there is very little effect produced upon the motor center, but the strain is directly upon the muscle used, collateral muscles acting with this, the tendons and framework, and par-

ticularly the heart and peripheral vessels. In acts which involve both force and swiftness along with accuracy, there is a large complexity in the physiologic act, and a most wide-spread strain is thus placed upon the mechanism—as, for instance, rowing a boat as rapidly and as long as possible. There is, again, another form of muscular action which involves a very considerable strain, but which is too often overlooked, and that is the passive physical tension illustrated by the perfectly strained muscular equipoise of a cat lying in wait for a mouse, in which almost every muscle of the body is used, including the controlling nervous mechanism in the brain, which here is in a form of concentrated attention (expectant attention). This latent energy produces very considerable fatigue, and directly in proportion to the degree of excitement and concentration of attention. It is familiar to all, and most of us can appreciate how fatiguing it is to stand for a long time, or to hold on to an object, as even a baby in the arms, the tiller of a boat, or the reins while driving a horse. The strain is doubled by an excitement which may again be emotionally exaggerated to the hypersensitive or overconscientious person in the performance or continuance of an act. It is not so familiar, perhaps, but equally important, to realize and prevent that sort of fatigue which is liable to occur in those who must remain quiet, but who excite themselves by subjectively aiding in carrying out conspicuous acts of another in their minds while watching them. For instance, an excitable person looking at a match game of foot-ball, influenced by eagerness for the success of one side, involuntarily puts forth an immense degree of energy by his desire to help along the others. Indeed, we have known of invalids who, while watching such contests in which one of their own family was contending, became seriously exhausted by just this sort of passive strain or expectant attention.

There is a distinct physiologic relief produced by the active forms of exercise which result in temporary breathlessness when followed by periods of rest. Physical and mental tension is lowered by profuse sweating ; excitement is relieved to a great extent by a normal or customary overaccumulation of carbon dioxid, which is itself a sedative.

It is well to bear in mind that for children intrinsically weak, both in their muscles and in their nervous force, and whose organs are also below the average power of their other parts, muscular exercise must be hedged about with many safeguards and thoughtful modifications. It is doubtful whether such children should be given much special exercise for their muscles alone, such as by pulley-weights, dumb-bells, and gymnastic

efforts, unless these be of the lightest and in combination with other things, while it is equally important that they should not be allowed too large a scope for exercises of a complex nature. Deliberate and continued acts, of which carpentering and gardening are familiar types, are the best. Indeed, the use of tools, involving as it does interest to the mind, is second to none in value for young or old, weak or strong. Complex exercises, involving both force and swiftness, should be gradually worked up to. The most perfect form of gradual approach is in the form of regulated exercises devised by the Swedes, wherein the muscular acts are reduced to their fundamental principles in force and direction; and in the hands of a skilful operator a person is led step by step from the simplest acts to the most complex and forceful ones, and during this process the organs also grow accustomed to the gradual strain. When the individual is vigorous enough to perform little acts of skill, incentive is thereby added and the muscular work is better endured. Later on minor competitions have their place, and so long as these are held in due restraint, all is well, and great benefit results from a judicious continuance. If incentive becomes insidiously merged into excitement, then a peril threatens. Exciting competitions are only for the strong; innocent incentive in the form of music during muscular exercises is often added with advantage. This is particularly illustrated in the exercises of the German Turn-Verein and Turn-Gemeinde.

Dancing is a most wholesome exercise, if only it be not superadded to or grow into undue excitement. "Fancy dancing" for girls is of special value, graduated, of course, as it brings out the graces as well as strengthens the muscles, teaches equipoise, and especially benefits the loins and back, the weakest places, and usually the most undeveloped parts in females.

Development of the Nervous System.—The development of the nervous system has points of similarity to the growth of a bank account, and is subject to somewhat the same variations: at times inadequate, again fairly sufficient, on extreme occasions running so low as to come to the verge of being overdrawn, but under no circumstances can it be excessive for the requirements of the child, if the growing needs are kept in mind. Nervous force grows most satisfactorily by slow and economic degrees; excitements of all sorts are perilous, inducing a waste in one way or another, and only robust natures accumulate enough to squander, lest peradventure the account be suddenly overdrawn and bankruptcy ensue. It is popularly admitted that the world is swayed by vigorous nerve force. Language is replete with

terms making nervous energy synonymous with courage, endurance, wisdom, and all those factors, in short, which are embodied in the term "success." It is alone the lack of nervous force which sometimes makes inefficient an otherwise sound bodily organism. On the other hand, a feeble construction, endowed with vigorous nervous force and energy, constitutes an efficient engine. An adequate accumulation of energy in the nerve-cells and centers is the very fountain and mainspring of a wholesome life. As we possess little or much of this are we useful or negative beings; whether our actions are mainly mental or physical, it is the same. When this energy is exhausted or run down, it must be wound up again, but, unlike the clock, it requires a long period of time in accomplishment. Moreover, during this time all the vital organs tend to deteriorate structurally while this controlling force is withdrawn. To acquire nervous vigor its growth should suffer few and small interruptions. We see among country folk, laboring men, and savages, natures which are relatively little disturbed by protracted drains on their vitality, especially of the kind which induces physiologic irritability in more complex beings, and this is due largely to their slow growth and simplicity of life, slowing storing up cellular energy. Such folk become not only well filled with force, but tenacious of it and well balanced. If their store is suddenly or excessively drawn upon, they can well sustain the tax. Children whose lives are passed in one long monotony may not be so bright and alluring as are some others, but they are far more stable, and better able to labor and endure. Their observation is simpler and slower, but their concepts and inferences are apt to be clearer. This storing-up of vital energy should begin before birth. The about-to-be mother should sacrifice something to enable her to live quietly and heathfully. A vast deal of harm would be avoided, as well as trouble to the mother and anxieties for her child, if this prenatal period could be spent under natural and wholesome conditions. We have scarcely begun to know much about maternal impressions, but they are of deeper influence and significance than can yet be explained. Hurtful impressions are thus transmitted beyond a doubt, and beneficent ones even more truly and constantly. It is conceded that the finest known specimens of children are found among the British nobility, and, as has been said elsewhere in this volume, our insular cousins are more enduring than we, certainly in physical competitions, as in long-distance running. The conditions of their early growth and development are hedged about with unusually wise safeguards. If, as has been objected by sentimental observers,

these children see less of their parents than those of humbler folk, they are provided with the best possible substitutes in the way of caretakers and teachers. They are reared under the most perfect conditions as to surroundings, almost altogether in country places; whereas those children compelled to live with their parents—who, having a good many demands upon them, are unable to devote their best energies to the care and instruction of their offspring—are liable to grow up haphazard, and fall into many dangers, in spite of the best affection and intentions. Indeed, there is a manifest peril for a child to be provided with too much or too solicitous affection from unwise parents, and although home influences are inestimable in the way of character growth, nevertheless the exigencies of modern life too often call away the best energies of the parents, and children come in for what is left.

A word may be said in passing of children who are backward mentally, a condition which frequently is only relative, being a state of instability of the nervous equilibrium, from which good or evil results may follow, depending upon the same conditions which help or prevent the growth of the nervous force in the body elsewhere. By far the most important considerations have to do with the acquirement of physical invigoration. If mental feebleness is once recognized, it is beyond measure important for the parents to seek skilful advice and to follow it closely. The education of the mind and of the body should go hand in hand, and all forced forms of mental training should be avoided. If the parent is able and willing to be the caretaker, and spend a good deal of time in the open air, especially the fields and barnyard, thus insidiously teaching and molding both mind and body, sharpening observation, and aiding in the formation of clear mental concepts, immense good can be accomplished, and, not seldom, the prevention of serious mental warping.

Development of Mind.—It is important that a few remarks be made on the development of mind as tending to show the connection which the brain and its processes have with enfeebled bodies. We occasionally see precocious minds endowed with very feeble envelops. If such brains are overencouraged, they are capable of using up too readily what little residual vigor there is in the entire organism. Precocity is a manifest peril;* it is ever of doubtful value; the very abnormality is evidence

* Precocity is a loss of balance between the bodily and mental growth of children in which one or the other element may predominate, but rarely both appear together. This state is scarcely one for parental gratulation, and always demands exceptional care to check on the exuberant hand and develop on the lacking side. It is seldom

which should put us on our guard, so that we should aid in preserving not only the organic activities and groundwork, but, above all, the integrity of the mind itself. Other things being equal, the mind should receive little or no special attention until the rest of the organism is fairly well repaired and put in working order. Actual instruction had better be delayed, and the teaching should always begin with the simplest possible object-lessons; suggestions such as emanate from well-conditioned, wholesome-minded folk should surround the child, even then keeping very close to simple, uncomplicated truths and their practical application. The method of teaching as outlined by that wise and good man, Froebel, is the healthiest both for the weak and the strong, and no system has ever been devised which approaches it in wholesomeness, certainly for very young children. Along with physical weakness there is inevitably a certain lack of mental vigor, and this must be particularly borne in mind, no matter how intelligent or bright a child may seem to its admiring parents or worshiping relatives. Mental processes are purely the outcome of physical activities, and there are in history conspicuous instances of great intelligence, and possibly wisdom, pointed out as existing in wretchedly undeveloped bodies; yet such are always open to question, and in the ordinary course of every-day life we certainly can not assume that this unnatural juxtaposition is probable. Therefore it must be assumed from the outset that in a feeble body the mind must be handled with unusual delicacy and judgment to enable it to develop according to its possibilities, no matter how highly or hopefully we estimate these. At least, the regularity of the organic activities must be fairly good to enable a structure of such astounding delicacy as the brain to grow naturally in size and power, and there must be maintained a very high order of cellular integrity to enable that organ to reach even a fair degree of energizing capacity and delicate differentiation. If this is true of early, budding infancy, when the whole organism is largely that of a vegetable, and until the time of early adolescence, when the brain reaches its normal bulk, it is even more important that from that time on to maturity, which is about the twenty-fifth year, every care be exercised to enable the normal perfection to be reached. When, then, instruction shall be admissible for a little one is a matter of much difficulty to decide, and just how much and of what sort this shall be depending,

---

or never accompanied by intellectual balance. A capacity for sustained action, mental or physical, is unusual also, and in many ways such children are disturbing factors to their families and themselves, and usually come to ultimate grief. They need isolation and systematic physical development of a slow and quiet kind.

of course, upon the material with which one has to build. However, the ordinary method of teaching language, dividing it up into letters and constructed words, leading thence to the principles of language, and finally to abstract thought, clothed too often in almost incomprehensible phrase, is certainly far from wholesome for those of the weaker sort.

Simple inductive reasoning from natural objects, of their quality, habits, and means of growth, is the kind of teaching that should be pursued. The average teacher knows pitiably little about what the mind of man in this budding state is capable of doing. We would urge upon all who have any desire to know the truth to begin by learning what the ordinary concepts of a young child are and how they shape themselves, and how language, as ordinarily learned by him, so misleading, is capable of conveying or distorting thought.

FEEBLENESS IN GIRLS ABOUT THE AGE OF PUBERTY.

Girls who become pallid and feeble about the time of puberty constitute a more or less constantly recurring group of cases, and present themselves with a series of symptoms indicating symmetric enfeeblement of mind and body, becoming lackluster, losing interest in life, and are a source of considerable anxiety to their parents. Too often this group of symptoms escapes the attention it deserves; a medical adviser trying, perhaps, several methods to relieve and failing, gives the time-serving advice to allow this child to outgrow the difficulty. Of course, if any organic disturbance is detected; if there is anything obviously amiss in the digestion or elsewhere, and these difficulties are removed, then in the removing of that which is obvious other disordered states are helped, and final recovery, partial or complete, may be the result.

So long as girls are in the vegetative stage, with undeveloped sexual tendencies, while they romp and play as boys and girls should do, all goes well. The requirements of civilized society, consciously or unconsciously recognized, which limit the too boisterous play of girls, causing this to stop or offering discouragement, inducing an early oversqueamishness about getting themselves dirty, or making more noise than custom encourages, taking more interest in the refinements of life than the essentials, gradually produce in girls approaching puberty an exaggerated sense of the importance of refined conduct. This is by no means confined to the upper class, although, perhaps, more generally seen there.

Often very early the human female begins to suffer from slowly acting bowels; not only so, but unless the opportunity for evacuating these is hedged about with all kinds of artificial safeguards, any discouragement will result in neglect. Teachers in schools admit this when differences between boys and girls in this particular are pointed out.

An examination of the girl who seems to have lost her interest in life will usually reveal loss of appetite or overparticularity in choosing of foods, often some vitiation of tastes, lack of muscular capacity, perhaps some evidence of dyspnea on exertion, irregular or slow-acting bowels or recognizable failure in circulatory activities, especially clammy hands and feet, heaviness of breath, and if the lungs are examined, the apices are seen to be insufficiently expanded. The heart exhibits evidence of dilatation, or, at any rate, there is a flabbiness about it and a distance to its sounds, a heaving impulse, and the pulse becomes overreadily disturbed in rhythm upon motion or excitement.

The girl will be more inclined to read and employ herself in sedentary fashion, and will lack spontaneous activity and alertness. The blood, if examined, will be found defective in hemoglobin; the urine perhaps of the highest specific gravity, probably alkaline, or, it may be, considerably increased in amount, or these conditions may alternate. The symptoms are vague enough to escape attention ordinarily, but prompt and persistent remedies are here of almost as much importance as in more seriously disturbed states. If all this is neglected, the girl's character may sometimes be grievously altered and her future changed. She may be regarded, however, as merely quieting down from her hobbledehoy stage, and many mothers will usually welcome this.

Remedial measures are most important, lest worse things follow, and should be persistently employed for months rather than weeks, continued, it may be, for years. Nothing is of more importance than that the physician shall gain the confidence of his patient and secure her cooperation. If she will be frank and candid in discussing the matter with him, he will very often find much that would otherwise remain obscure. There are numerous psychic conditions which demand careful weighing—the doubts, the fears or ambitions, more likely a hypercritical self-examination; at any rate, an increased introspection, and not seldom a rather interesting and original conception or expression of views on life which will amuse and instruct the investigator.

The chief difficulties and needs have to do with the question

of supplying incentive, the devising how to secure an increased interest in life in its wholesomer aspects. Lack of incentive is the greatest stumbling-block in dealing with apathetic folk, whether children or adults, and here the personal factor, the force and individuality of the physician, comes in most strongly, and some men can infuse a greater degree of enthusiasm into their patients than others.

As to how we shall accomplish initial movements, an awakening of interest and invigoration of the will, few rules can be outlined or defined. It is a good plan, however, to strive earnestly to impress, not only the necessity of doing as we direct, but to urge this with such subtlety and tact and, withal, extreme persistence and variety in our methods, that the result may be surely obtained soon or late. Flattery is an important agent, stirring the vanity which every one possesses, or should possess, and it is perhaps nowhere more influential than in dealing with girls, for the key-note of success lies here. Of course, it is impossible to expect much success in shaping or directing forces until there is enough of inherent vigor present to warrant activities, whether of the mind or body.

The first organ to be looked to is the heart, not neglecting, of course, the digestive conditions. A powerful heart tonic used for a few days or weeks will help more than any other one medicine, and it is our custom to add to any tonic used digitalis (digitalin) or strophanthus or nux vomica in full doses. So soon as we can secure a full, regular, strong pulse, and one which is not subject to more than the normal variations from lying, sitting, or standing, and swift movements, we have the most important physical point gained. The amount and character of the animation are fair indications of the usefulness of our heart tonics; the urination is also a helpful index, and these should be reduced to uniformly demonstrable measures.

The digestion requires assistance, and the predigesting agents, such as pepsin or pancreatin in elixir, are not only of value, but good menstrua for other drugs. The bowels must be kept sufficiently active. The food should be supplied in adequate amount, using exact measurements, and had better be highly albuminous, at least for a time. There is usually little appetite for meat, and often revolt at milk. Regulated amounts of broiled or scraped beef or mutton, along with predigested milk or koumiss, will soon show results. Along with the digestive tonic it is well to use mineral acids, muriatic or, preferably, nitro-muriatic, especially where the urine is found to be alkaline—a very common factor of mental depression. Most cases of ane-

mias in this class, as well as in younger children, are due to faults in the intestinal digestion, and important medicines, aside from those alluded to, are forms of myrrh, such as aloes and myrrh, and the intestinal antiseptics, salol, benzonaphthol, and bismuth; sometimes the use of castor oil, either once or twice a week at first, to secure thorough evacuation, or in smaller amount in capsule three times a day, immediately before meals, in ten- to twenty-minim doses, is very helpful in catarrhal states.

Many girls get into the luxurious habit of sponging themselves piecemeal, in driblets of lukewarm water, or taking a warm or hot bath, which they declare is a great comfort and pleasure. It is, of course, not wise to insist on a cold bath at once, especially where menstruation is irregular, but this can be accomplished by the help of a competent trained assistant or a good nurse or maid. The use of cold-water sponging or bathing should be learned and practised. A good way to begin is this: Let the patient stand in about three inches of warm water; get a maid to sponge her off in a little of this, immediately following with a larger sponge, rapidly going over her with cool salt water, growing colder each day until it is quite as cold as the room in which she stands, or more so; follow immediately by a brisk rub-down, until the skin acquires a prompt reaction, and there comes a clear pink color from head to heel. This bath, in the event of marked weakness or if it be followed by exhaustion, is better given after a partial breakfast, such as a cup of cocoa, and followed by rest in bed for half an hour, then the bath given by a maid, a rough rub-down follows, and, finally, breakfast. As the girl grows stronger she will take her cold bath herself and learn to enjoy it. It is valuable also, after some regular outing or exercise, to take another salt sponging, not so thorough, perhaps, or a brisk rub-down, and a rest, lying down from half to an hour, say, until the end of the afternoon and until the evening meal is ready.

The kind of exercise suitable to such cases is too large a subject to discuss in full. One thing is manifest: the habitual inaction reacts upon the heart, increasing its feebleness, from whatsoever cause that may have come. A slowly and carefully increased exercise, not too monotonous, along with vigorous tonic medication, will repair the fountains of motor force.

The lungs will usually be found insufficiently expanded, at the apex especially, and respiratory gymnastics are indicated if some one can be found to direct them properly, and this the physician himself should supervise. Forced deep breathing, with a few forced stretchings of the arms, twice or thrice a day, will ac-

complish needed expansion and greatly aid in oxygenating the blood. The use of medicated inhalations is helpful, or the use of whatever agencies will produce a deep, full respiratory action. At first the patient will complain that it makes her dizzy, and, being more or less apprehensive about her physical state, she will object. So soon as she can be induced to take mild open-air exercise (of which walking solemnly along the street is emphatically not the best and not even a good form), she had best be encouraged to do so. The so-called calisthenic exercises, which mean "beautiful forcefulness," probably because they are usually so hideous, are devoid of interest and not particularly useful. Only that exercise is best which involves some pleased acquiescence in the performer or some interest in the doing. Fancy dancing, as previously remarked, admirably develops loins and back.

Tennis is also very well, but too violent for girls below par, and certainly until the patient gets into a moderately good condition. Golf is one of the best possible exercises and is to be highly and persistently recommended. It can be played at any time, for any length of time, alone or in company. A giant may play even with a dwarf by handicapping. The bicycle has the very profound merit of being acceptable to most persons, at least nowadays, while it is still generally used; it may not be the best thing to use, but it is certainly best to use something that is not harmful, and in most cases this fills a very obvious need. The bicycle is monotonous, and the character of movements is restricted by the rotary mechanism, hence it develops unsymmetrically and may exhaust before tiring the muscles. Cycling is a peril because of the competition of companions who lure the weak ones too far. Girls should not push up steep hills and never attempt to keep pace with powerful young men. The strain on the eyes often gives headaches; constant unremitting balance also fatigues; both together cause migraine frequently. Swimming at the seashore or elsewhere is of admirable efficacy. Rowing gently in a skiff; the old-fashioned game of croquet, most unfortunately now out of fashion; the excellent and ancient game of graces, which really was more or less graceful; and that obsolete practice known as battledore and shuttlecock—all have merit. For those who can afford it, or in whom it is warranted, it is certainly best to prescribe and supervise a course of massage and regulated exercises in the form of specially prescribed movements; but the discussion here has rather to do with cases who do not care to be considered invalids, yet none the less require the full attention of physician and parent.

Girls who go to school are the victims in these days of vaguely defined forms of exercise called "physical culture," usually demonstrated by one of the least busy of the teachers, who tells them to stand up and wave their arms to a one, two, three order, and the uninterested girls present, under these circumstances, acquire a most listless, imbecile expression. But this is better than nothing, —better by far than sitting all day stagnating,—and may serve a more or less useful turn. Under the direction of a qualified teacher posing, stretching, bending, and tension exercises are of incalculable value. If, however, the time so used were employed in tossing back and forth a good old-fashioned bean-bag from one to another, or that most useful of exercises, the medicine ball, causing it to make the circuit of the room, and omitting no one; perhaps keeping two or three going, giving eye and hand and brain all an opportunity of acting together, and involving, as it does, some little amusement of a competitive kind, and requiring some personal nimbleness and skill, would be the best employment for the short recess in the ordinary girls' school. When the weather admits of it, the best thing to do would be to don overshoes and warm head-gear, a pair of old gloves, and toss this medicine ball about out-of-doors. But if this be objectionable to the oversqueamish teacher or parent, let the windows be opened wide and the girls kept at exercise for ten minutes pretty actively; they would thus get a mouthful of clean air and a stirring-up of the blood, with absolutely no danger of "catching cold." It is, indeed, one of the most difficult problems first to select and next to carry out the proper means of developing the bodies of our growing girls. The subject is woefully neglected, although there are a good many fashionable attempts made, and the results are, in a measure, satisfactorily growing. There is much to be said in favor of the so-called relaxing exercises, when skilfully taught by one who can elicit some interested cooperation, accompanied, it may be, by music, and supplemented by posings and graceful, rhythmic stretchings and deep, regulated breathings. Class work is of value as sustaining interest and attention. The best teaching is in private, by a mistress of the art, who will judiciously increase and vary the movements in accordance with individual needs.

One word should be said just here about the various disturbances of regular menstruation when once established. These are very rarely due to any malposition of the uterus. The colicky pains, backaches, nausea, etc., are seldom more than the outcome of incomplete or irregular development in the uterine tissues, the local circulatory supply, or the nervous distribution, all of which

may be slow to adjust themselves to new and complex conditions. Most disturbances of the organs of generation in women, as the wiser gynecologists admit, are sequences of coition and pregnancies, partial or complete, or specific infection, or both—neoplasms excepted. Pelvic examinations can be predicted to be negative, and should only be practised when all other rational measures fail. These consist of due attention to the whole organism and systematization of special hygienic measures, as already outlined. But let it not be forgotten that once the attention of a neurotic girl is directed to her pelvic organs, her mind becomes infected with a germ of disease which may, and too often does, warp her life and that of all those in her immediate environment.

CHAPTER XIX.

CONDITIONS REQUIRING SURGICAL PROCEDURES.

LYMPHADENITIS.

Synonym.—LYMPHANGITIS.

Inflammations of the lymphatic glands are of great clinical importance and not very simply classified as yet; they may be acute, chronic, or tuberculous.

These glands are so situated that they act as sentinels to the circulatory system, and, being endowed with bactericidal power, they have the power of destroying or neutralizing poisons, and it is only by the overwhelming numbers of bacteria being absorbed that they themselves become affected, for, according to recent investigations, inflammation of the lymphatic glands is caused by the absorption of some form of bacteria or toxin, invariably from a more or less distant focus—that is, from without. The axillary, inguinal, cervical, bronchial, and mediastinal glands are the ones most frequently affected.

ACUTE LYMPHADENITIS.

Definition.—Acute inflammation of the lymphatic glands.

Causes.—The most common causes of inflammation of the glands are the eruptive and infectious diseases, as scarlet fever, diphtheria, and septic wounds, diseases of the teeth, etc. The face and neck, being largely exposed to slight traumatism and protected by a thin epithelium, furnish a fertile infection atrium.

Pathology.—A lymph-node is the first filtration station against the invading micro-organisms, and in many instances it is altogether, or again only in part, able to repel the attack. Failing in this, a chain of glands becomes infected, the degree of damage is in proportion to, being modified by, the inherent resisting power of the individual. In acute inflammation the gland becomes intensely vascular, with free exudation; the

escaping leukocytes there, as well as those in the lymph coming from the primary focus, are retained and accumulate in the gland until it is impossible to recognize the cortex from the medulla. By removing the cause the process gradually subsides, the new elements undergo disintegration and absorption, and the gland returns to its natural condition (resolution) or may remain chronically enlarged. If the process goes on to suppuration, the trabeculæ of the gland are destroyed and the loculi become filled with pus, and the surrounding connective tissue becomes inflamed and suppurates.

Symptoms.—General symptoms are usually slight, depending upon the severity of the cause. Local symptoms are pain, heat, swelling of the gland or glands; the skin, as a rule, is not affected. If the periglandular tissue is not involved, upon examination there will be found a well-defined tumor, hard, elastic, and movable. If the pain and swelling become less and gradually disappear, resolution results; if, on the other hand, the pain and swelling increase, the skin becoming red and edematous, the tumor immovable, and, instead of being hard and elastic, it is soft and fluctuating, we know that suppuration has taken place, usually accompanied by a chill and rise of temperature.

Diagnosis.—Diagnosis is usually easy; as we have seen, adenitis is invariably caused by some external source of irritation, except in cases of deep-seated or visceral adenitis, when sometimes it is impossible to determine the source of infection.

Prognosis is, as a rule, favorable, except where there is extensive suppuration, especially in the neighborhood of important organs and vessels.

Treatment.—Our first step in the treatment is to seek for and to try to remove the primary cause.

Local Treatment.—Absolute rest of the part affected is indicated, along with the applications of cold (cold-water compress), antiseptic solutions, as bichlorid of mercury, 1 : 2000 or 4000, a mercurial or ichthyol (25 per cent.) ointment, or, if it can be borne, slight compression; the interglandular injection of carbolic acid. It is important to secure resolution if possible, as many changes of a reparative and protective character take place among the blood-cells.

Electricity—the continuous current—has been used with fairly good results, daily sittings of ten minutes of from five to fifteen milliamperes. Constitutional treatment should not be neglected, and should be especially supporting. A free saline purge at the onset is often most beneficial.

When suppuration is plainly evidenced, a free incision should be

made, and the cavity then washed out with peroxid of hydrogen or other antiseptic solutions and packed with gauze; when persistent and stubborn, the cavity had best be curetted, or, should a fistula form, then curetment is necessary. If this proves unsuccessful, it should be laid open.

Chronic Adenitis.

Chronic adenitis may follow the acute form, or the disease may be chronic from the beginning, and while it is not necessarily tuberculous, in the large majority of cases it becomes so.

Etiology.—Simple chronic adenitis begins, like the simple acute form, in some point of infective invasion from without, such as chronic skin troubles, ingrown toe-nails, caries of the teeth, producing inflammation at or around the roots. The infective material may remain dormant in a gland after the disease process at the point of invasion has been cured, and yet from some slight cause the poisons may again become active.

Pathology.—In simple chronic adenitis the reticular structure becomes thicker and more fibrous, the lymph-cells diminish in number, the gland becoming hard and fibrous. In the first stages of a tuberculous gland, as a rule, it is redder than usual, though sometimes it may be gray and somewhat translucent.

The tuberculous granules are made up from the vascular and lymphatic vessels found in the cortical and medullary portions of the gland. Caseation rapidly develops in them, and is due to vascular obliteration.

When caseation is established, almost all of the bacilli have disappeared, but the spores remain, which are capable of reproducing the disease. The presence of the bacilli is rarely demonstrable in the product of the glands, but when guinea-pigs are inoculated with the pus, they readily become affected with tuberculosis. Tuberculous adenitis may be a local disease, undergoing spontaneous resolution, but so long as the focus is present it constitutes a menace to the system.

Symptoms.—Swelling, which may develop gradually or remain from an acute attack, no pain, no redness of skin, movable, but may in time, through peri-adenitis, become glued to the skin, especially if more than one gland is affected.

The symptoms may be divided into three stages: First, that of induration or indolence; second, that of inflammation; third, that of suppuration.

The first stage may last for years; the glands are hard and elastic. In the second stage they take on activity, becoming painful and tender, with more or less redness of the skin.

In the third stage the gland softens, the skin ulcerates through, and the contents of the gland, a caseous matter mixed with a whitish, watery fluid, is evacuated; the resulting cicatrices are adherent, depressed, and very disfiguring. The low grade of inflammation of chronic adenitis forms a good soil in which the tubercular bacilli may grow. Certain observers claim and adduce strong testimony to prove that when enlarged glands in children persist and finally pulmonary tuberculosis occurs, the infection is conveyed from the glands to the lungs, the pulmonary trouble being secondary to that of the glands. Seventy or eighty per cent. of enlarged cervical glands may be said to be tuberculous. The cervical and mesenteric glands are most frequently affected in children, but in acute conditions, such as the infectious fevers, they become more widely engorged.

Diagnosis.—Chronic adenitis invariably arises from some definite point of entrance, some lesion, such as chronic skin troubles, tonsillitis, ulcers, etc., one or two glands only being affected. In tubercular adenitis usually the entire lymphatic system is more or less affected. From syphilitic adenitis the simple forms can be differentiated by the history of a primary sore, etc., rarely seen, however, in childhood.

In lymphadenoma the tumor is larger and does not suppurate. In lymphosarcoma there is longer duration and a much larger size of tumor before it breaks down. Polyadenitis in children is said to be a diagnostic sign of tuberculosis; Hodgkin's disease (lymphatic anemia) must be differentiated by the characteristic symptoms, anemia, dyspnea, etc.; also the tuberculin test is clearly indicated and will almost certainly make the diagnosis clear.

Prognosis.—Chronic adenitis may end in resolution or in suppuration. The pus may burrow around large vessels, and so weaken their walls as to produce fatal hemorrhage. If the gland should be tuberculous, there is always danger of general infection.

Treatment.—The constitutional treatment of chronic adenitis is most important, good food, hygiene, and plenty of fresh air being prime factors in the restoration. As to drugs, we rely principally on reconstructive agencies, iron, arsenic, oils, and nucleo-albumins. When possible, a change of climate should be prescribed, especially in tuberculous cases. The good results obtained in tuberculous cases from high altitude and dry climate, like that of Colorado, is at times marvelous, and when possible, it should be taken advantage of, while sea-bathing is very beneficial and should be recommended in such cases.

Local Treatment.—Resolvents are indicated, such as an ointment of iodin and iodid of potash, or an ointment of ichthyol or ichthyol and mercury, gently rubbed in at night. The interglandular injection of two minims of a 10 per cent. solution of chlorid of zinc once a week, or three minims of equal parts of carbolic acid and glycerin, is said to excite the growth of a new fibrous tissue which encapsulates the diseased portion. In twenty-three cases reported by Lennelongue, in which he used the chlorid of zinc solution, fibrous encapsulation occurred in every case. Extirpation of the gland is strongly recommended by some of the best surgeons, but we must never lose sight of the fact that in removing the entire mass of glands of one region we remove the valuable sentinels, or guards, but so long as these canals are severed they can no longer act as avenues of invasion to bacteria. It would, therefore, be better to leave total extirpation as a last resort. If the gland should suppurate, incision, curetting, and packing with iodoform gauze are indicated. To sum up the treatment: first, through constitutional and local remedies, backed by climatic environment. If possible, endeavor to secure resolution, leaving total extirpation as a last resort; if, however, the glands involved should be few and there is a strong suspicion of their being tubercular, it is best to remove them at once. Should the glands suppurate, proceed to incision, curetting, and packing.

INJURIES AND SHOCK.

Children bear injury badly, and in them shock is most marked. A slight loss of blood in a child frequently causes serious prostration, but the recovery is equally prompt and complete.

A description of the most serious injuries will be found in works upon general surgery and upon the special surgery of childhood, and it is therefore unnecessary to attempt to give a list or an account of them here.

Burns.—Burns from fire, acids, lime, and other corrosive agencies, as well as scalds from hot water, tea, soup, or, indeed, whatever cause, are best treated at first by a normal salt solution, sterile, or a strong solution of bicarbonate of soda. For soothing qualities the application of the oleaginous preparations are not particularly clean, but most comforting, such as boric ointment, carron oil, etc. This may be put on over the injured part, which is then enveloped in sterile absorbent cotton and placed at rest. If the destruction is more than superficial, ulcers will form, which must be treated upon general antiseptic prin-

ciples. Here the bichlorid solution can not be safely used, at least not constantly.

Children bear all forms of chemic antiseptics badly, and these frequently retard, if not entirely prevent, wounds from healing. Dry powders of a simple character, such as bismuth, oxid of zinc, and, if the area upon which treatment is to be directed is not large, iodoform, are better than many of the stronger germicides.

In the healing of burns and scalds cicatricial contractions of the skin and deeper tissues are to be expected unless great care is exercised in keeping the limbs extended. Simple splints or weights and pulleys, if the contraction is of the lower extremities, will often prevent a very considerable amount of deformity. If, however, these simple measures are not efficient after thorough and persistent trial, skin-grafting, after the contracting bands are divided, should be used to close the wounds.

Shock.—The treatment of shock is to put the child at once to bed; surround it with hot-water bottles or hot-water bags, but be certain that they are protected so as not to burn the skin; give rectal injection of one or two ounces of black coffee and hot salt solution of a strength of one dram to the pint, and small doses of strychnin hypodermically. If no attempt at reaction follows this and the injuries are not of such a character as to prohibit the child's being moved, a hot bath is of very great service. Drugs and stimulants given by the mouth, unless there is some effort at reaction, are of very little service, because with children, even more than with adults, the shock absolutely arrests digestion and absorption from the stomach, and there is danger of filling the stomach with stimulants which, when reaction does set in, will become suddenly absorbed and cause the patient to be overwhelmed by their accumulated action.

HARELIP.—CLEFT PALATE.

Harelip may be single or double. It may involve simply the lip or be associated with cleft palate. Both are due to faulty development of the fetus.

Children marked with this deformity are usually unable to nurse from the breast, as the power of suction is lost, and require the greatest care in their management. The harelip must be operated upon early,—a few weeks after birth, if possible,—leaving to a later age—from three to six weeks—attempts to close the cleft palate.

The closure of the cleft palate is best done at two sittings, if the cleft is extensive. The first operation should be upon the hard palate; in a few months the cleft in the soft palate should be repaired.

It may be necessary to resort to the forced feeding of the child by means of a soft-rubber catheter and syringe. A specially constructed nipple with a shield to fit over the cleft in the palate sometimes answers in very young infants. These children are always of low vitality and, in spite of all efforts, may die very early.

DISEASES OF THE JOINTS.

Diseases of the joints are acute and chronic. The acute inflammations, synovitis and arthritis, are produced, first, by injury; second, by rheumatism; third, they occur in acute infectious processes, as in the case of scarlet fever and measles.

The acute arthritis of infants which we see occasionally after the eruptive fevers is an acute septic process, with very rapid destruction of the joint and the surrounding tissues. The correct diagnosis of the character of the lesion is imperative, and if suppuration occurs, active surgical interference is needed to drain the joint and prevent further destructive changes.

Inflamed conditions of the joint following injuries are treated on general surgical principles: by absolute rest and splint, with hot or cold applications, the time-honored remedy, lead-water and laudanum, being of comparatively little value.

In acute stages ichthyol and lanolin, 12.5 to 25 per cent., rubbed into the joint after the heat is applied, is frequently of great benefit. The most essential point, however, is rest. If the joint is very much distended, either by blood or articular fluid, it may be well to aspirate, but only under the very strictest antiseptic precautions. The products of inflammation in the joint must be removed, or they will lead to the formation of adhesions and frequently destroy the usefulness of the joint.

By far the most common cause of joint disease in children, and, indeed, of diseases of the bone as well, is tuberculosis. The ankle, knee, hip, spine, in fact any or all of the articulations of the body, may be infected.

Tubercular diseases of the joints should be treated by conservative methods. Absolute rest in plaster-of-Paris and some form of splint apparatus, and injections of iodoform and glycerin may be tried. The method of passive hyperemia, as used in Germany, and which consists in constriction both above and below the joint with rubber bands, the restriction being only suf-

ficient to cause venous engorgement without completely cutting off the venous circulation, may be cautiously tried. This will require care and watchfulness and a long interval of time, but the results, in many instances, are undoubtedly beneficial. When, however, the destructive process has advanced to such an extent that the joint is totally destroyed, and when the tubercular infection is very profound and the pain acute and persistent, so that the child's bodily health is rapidly failing, arthrectomy, or excision of the joint, should be done.

Bear in mind that arthrectomy, or excision, will only give, at best, a mutilated limb, but it will often be demanded as a life-saving measure on account of the rapid progress of the disease.

Complications are abscesses, which are not true abscesses from a bacteriologic standpoint; they are formed by the breaking-down of tubercular deposits, and are called abscesses, though they do not contain the germs of suppuration; they are made up of cheesy masses of broken-down tissue which are loaded with tubercle bacilli. When such abscesses form, if after a reasonable time absorption has not occurred, they should be freely opened, so that the whole interior may be evacuated. The granulation tissue, which will be found covered with tubercular deposits, should be curetted, first with a sharp spoon and then with a dull spoon, or gauze and sponges may be used. All the time a constant flow of distilled water should be employed to wash out the wound, every particle of the material being scraped away. The wound is then to be closed, without drainage, after a small amount of iodoform has been dusted into it. This method of treatment, however, is only of use when the greatest care has been exercised to perfect the antiseptic technic, for if this is not the case, the wound may become infected by pyogenic bacteria—a double infection will be present, and much more serious results ensue than if the abscess were allowed to break of itself.

Many surgeons of wide experience in this class of cases totally oppose any surgical interference whatever, claiming that in a vast majority of cases the ultimate result will be better if the opening occurs spontaneously and the discharge of the diseased tissues is left to nature than if the abscess be artificially emptied, and that the danger of mixed infection is very greatly reduced; also the resulting scar is smaller when the abscess is allowed to open spontaneously. This is totally opposed to the authors' own personal experience, but it is the view held by a very large number of orthopedic surgeons.

White swelling, or tubercular arthritis of the knee, is one of the most common diseases of the joints in children. Next, **hip-**

joint disease, ankle-joint disease, and Pott's disease of the spine, or spondylitis, occur most frequently. In all these cases the most important element of treatment is absolute rest of the joint, at first by confinement to bed and the bed-frame; next, by good food and good hygienic surroundings, fresh air, bright sunlight, and, lastly, by a perfectly fitting splint or brace.

INFECTIOUS OSTEITIS (OSTEOMYELITIS).

This is an acute inflammatory process of the bone, due to infection by staphylococcus and streptococcus, which find entrance into the tissue either through a wound in the soft parts connecting with the bone or by absorption through the general circulation, and are deposited at some point where the vitality of the tissues is impaired, either by traumatism or disease. It frequently follows the eruptive fevers. The epiphyses of the long bones, and especially of the femur and tibia, are the most frequent seats of the disease, which soon extends to the shafts of the bone. It is so destructive in its consequences that the whole of the bone may be destroyed. It is, therefore, necessary that an early diagnosis and prompt method of treatment be instituted.

The **symptoms** are those of intense septicemia, with high temperature, pain in the limb, swelling, and an acute abscess, which rapidly burrows.

The **treatment** consists in freely opening the tissues down to the bone, trephining and chiseling the bone itself, and eliminating from the cavity the product of the infective disease. Many cases of so-called infective rheumatism in children are really those of osteomyelitis. The condition goes on for months and months; the destruction of the bone is very extensive; abscesses form and break spontaneously, and after a time the whole of the bone will be destroyed. If, however, in the early stages the disease is recognized and promptly treated by a surgeon, many months of suffering will be saved and the limb be preserved, with only a moderate amount of deformity.

OPHTHALMIA IN THE NEW-BORN.

By this term is usually meant a form of conjunctivitis occurring in new-born infants, produced in the majority of cases by infection from the vaginal secretion of the mother, who has previously been infected with gonorrhea. In mild or moderately severe cases the disease is limited to the eyelids, the conjunctiva, or the subconjunctival tissues, but when the infection is severe, there

may be ulceration of the cornea or even perforation of the eyeball.

Causes.—Mild cases of inflammation and swelling of the eyes may be produced by continued pressure during birth, or from the eyes of the child coming in contact with a vaginal discharge if the mother suffers from a simple catarrhal vaginitis. Even a healthy lochial discharge may produce a slight inflammation. True ophthalmia is, however, in almost all instances produced by the eyes of the child coming in direct contact, during labor, with a vaginal discharge which is either infected with the gonococcus or with ordinary pyogenic germs.

Uncleanliness on the part of the nurse—as, for instance, in the dressing and care of an infant after attending the mother who has been infected—may be a cause.

Symptoms.—The disease usually begins about the third day after birth, the first symptoms being redness and swelling of the lids, the conjunctiva, and the subconjunctival tissues, and is immediately followed by a very free purulent discharge. The discharge is yellowish or greenish in color and may be blood-streaked; sometimes, indeed, there may be distinct hemorrhages. In a short period of time ulceration of the cornea, followed by sloughing, takes place, and unless the disease yields to treatment, a perforation into the anterior chamber of the eye follows. When gonorrheal poisoning has been the cause, loss of vision very often results unless the case is seen early and very energetic and careful treatment is instituted. Neglected cases may end not only in loss of sight, but in systemic poisoning by pyemia.

Treatment.—The prophylaxis of ophthalmia in the new-born consists in first giving every woman affected with any form of purulent vaginitis or endometritis an antiseptic douche during the first stage of labor. The vagina should be thoroughly flushed with a 1 : 2000 or even 1 : 1000 solution of bichlorid of mercury, or a hot solution of creolin and tincture of green soap, equal parts, in the strength of one dram to the quart. This should be given through a speculum, care being taken that all the folds of the vagina be stretched and the whole birth canal thoroughly swabbed by means of wads of cotton held in a pair of uterine dressing forceps. The next step in the preventive treatment consists in dropping into the infant's eyes, immediately after birth, a 1 per cent. solution of nitrate of silver, which should be followed by a drop or two of salt solution in order to neutralize any excess of the nitrate of silver. In some cases a thorough cleansing of the eye with a saturated solution of boric acid does well. When the eye has become infected, the treatment must

be prompt and each step accurately carried out. The strictest antiseptic precautions must be used to prevent the infection from spreading to the other eye where only one is affected, and also to keep the disease from attacking those who attend the patient, or, in hospitals, from spreading to other inmates. All cases of ophthalmia neonatorum should be isolated, and a special nurse be set apart to attend such patients.

The treatment consists first in cleansing the eye every twenty or thirty minutes, night and day. This should be done by instilling into the conjunctival sac solutions of boric acid, by means of the ordinary grooved eye-dropper or a dropper with a bulbous tip. Care should be taken that the fluid is introduced well into both angles of the eye, and without force, taking care to empty the region thoroughly of pus. In order to reduce the inflammation there should be constantly applied to the eye small pieces of lint or absorbent cotton,—compresses, in fact,—which have been rendered cold by letting them lie on a cake of ice. These should be applied every minute, at least, and this treatment should be continued as long as any discharge continues, taking care that these are not used should the cornea in any way become involved (haziness, ulceration, etc.). Such cases are then much better treated by the substitution of heat until the cornea returns to its proper condition, when cold may again be used. It has been recommended that a few drops of a 1 per cent. solution of nitrate of silver should be instilled into the eye. In all cases the pupils should be dilated with atropin. It is of the utmost importance that all dressings, etc., coming from the patient should be burned as soon as removed, and the nurse must take the greatest possible care in washing her hands both before and after attending the case.

INDEX.

A.

ABDOMEN, shape of, in children, 28
Abdominal massage in chronic constipation, 226
respiration in infants and children, 26
Abscess, acute hepatic, physical signs of, 271
ischiorectal, 241
multiple hepatic, 272
of brain, 589
retropharyngeal, 431
Acetonuria, 288
Acute articular rheumatism, 355
bronchitis, 452
bronchopneumonia, 463
congestion of kidney, 301
degeneration of kidney, 302
diffuse nephritis, 305
enteritis, 193
exudative nephritis, 303
fatty degeneration in new-born, 73
hemoglobinuria of new-born, 72
lymphadenitis, 818
milk infection, 200
causes of, 200
diagnosis of, 203
diet in, 204
hot bath in, 204
ice-cap in, 205
irrigations in, 204
pathology of, 201
prognosis of, 203
prophylactic treatment of, 203
symptoms of, 202
treatment of attack of, 204
rheumatism, 355
rhinitis, 426
yellow atrophy of liver, 280
pathology of, 280
treatment of, 281
Adenitis, chronic, 820
diagnosis of, 821
etiology of, 820
pathology of, 820
prognosis of, 821
symptoms of, 820
Adenitis, chronic, treatment of, 821
local, 822
in scarlet fever, 668
Adenoid vegetation, 430
Adenoma of kidney, 318
Adherent prepuce, 319
Adhesive strips, rubber, in umbilical hernia, 87
After-treatment of asphyxia neonatorum, 53
of intubation of larynx in diphtheria, 663
Agenesis, cortical, 581
Albuminous liver, 279
Albuminuria, cyclic, 300
in diphtheria, 638
in scarlet fever, 673
physiologic, 300
Alcoholic neuritis, 562
Alternating insanity, 538
Amblyopia in hysteria, 550
Amphophiles, 333
Amygdalitis, 433
Amyloid degeneration of intestines, 218
disease of liver, 279
diagnosis of, 280
pathology of, 279
prognosis of, 280
symptoms of, 279
treatment of, 280
Amyotrophies, 602
Anatomic changes in chlorosis, 336
Anatomy of heart, 391
Anemia, 335
lymphatic, 349
progressive pernicious, 345
blood changes in, 346
causes of, 345
diagnosis of, 348
morbid anatomy of, 345
prognosis of, 348
symptoms of, 347
treatment of, 348
secondary, 350
diagnosis of, 352
from inherited syphilis, 353
from rickets, 353
from tubercular diseases, 352

Anemia, secondary, prognosis of, 352
symptoms of, 351
treatment of, 352
simple primary, 339
splenic, 340
Anemias, primary, 335
Anesthesia, forms of, in hysteria, 550
Aneurysm, cardiac, 410
Anhydremia, 330
Ankle-joint disease, 826
Anomalous epilepsy, 517
Antepartum asphyxia, 45
Anterior fontanel, 36
closure of, 36
size of, 36
Antimony, effect of, on mother's milk, 118
Antitoxin, diphtheria, action of, 649
in limiting duration of the disease, 653
administration of, 649
clinical manifestations of, 652
curative dose of, 651
dosage of, 649
rules for, 652
effects of, on laryngeal diphtheria, 653
on pulse and circulation, 652
on temperature, 652
on the membrane, 653
immunizing dose of, 651
influence of, on mortality records, 653
technic of applying, 648
unit of, 648
Anuria, 285
causes of, 285
hot fomentations in, 286
prognosis of, 286
treatment of, 286
Anus, fissure of, 240
symptoms of, 240
treatment of, 241
prolapse of, 239
causes of, 239
cold applications in, 240
Paquelin's cautery in, 240
symptoms of, 239
treatment of, 239
Aorta, stenosis of, 396
Aortic disease, double, physical signs of, 416
insufficiency, 415
leaflets, disease of, 415
regurgitation, physical signs of, 415
Aphthæ, Bednar's, 158
Aphthous stomatitis, 157
causes of, 157
treatment of, 157
Aphthous vulvitis in children, 743
Apoplexy in new-born, 60
causes of, 60
definition of, 60
pathology of, 60
symptoms of, 61
treatment of, 62
Apparent death of new-born, 45
Appearance of infant at full term, 19
Appendicitis, 244
bacteriology of, 245
"calculous," 245
chronic, 250
diagnosis of, 248
etiology of, 214
hot applications in, 250
enema in, 250
ice-bag in, 250
McBurney's point in, 247
morbid anatomy of, 246
operative treatment of, 251
pain in, 247
pathology of, 244
salines in, 250
symptoms of, 247
temperature in, 247
the blood as a guide in the diagnosis of, 353
treatment of, 250
Appendix vermiformis, 34
Arm-to-arm vaccine inoculation, 686
Arsenic, effect of, on mother's milk, 118
in eczema, use of, 755
Arterial trunks, transpositions of, 397
Arthritis, 824
tubercular, 825
Ascaris lumbricoides, 256
diagnosis of, 258
symptoms of, 257
treatment of, 258
Asphyxia, antepartum, 45
neonatorum, 45
after-treatment of, 53
antepartum, 45
causes of, 45
curative treatment of, 48
extra-uterine causes of, 45
hot bath in, 49
Laborde's method of treating, 50
mouth-to-mouth insufflation in, 52
pathology of, 46
postpartum causes of, 45
prognosis of, 47
prophylactic treatment of, 47
Ribmont apparatus for, 53
Schultze's method of treating, 50
stimulants in, 53
Sylvester's method of treating, 50

Asphyxia, neonatorum, symptoms of, 46
synonyms of, 45
treatment of, 47
rubra seu apoplectica, 60
Asphyxie des nouveau nes, 45
Aspiration in empyema, 494
Ass's milk, 105
Asthma, bronchial, 458
diagnosis of, 460
pathology of, 459
prognosis of, 460
symptoms of, 459
treatment of, 460
following bronchitis, treatment of, 458
rachitic, 448
spasmodic, 458
Ataxia, hereditary, 601
diagnosis of, 602
Romberg's symptom in, 601
symptoms of, 601
treatment of, 602
Atelectasis, acquired, 491
in acute bronchopneumonia, 466
Athetosis, 517, 519
Athrepsia, 379
Atresia of intestine, 192
of pulmonary artery, 396
Atrophic rhinitis, 428
Atrophies, progressive muscular, 602
Atrophy, infantile, 379
of liver, acute yellow, 280
simple, 379
causes of, 380
diagnosis of, 382
diet in, 383
pathology of, 381
prognosis of, 383
symptoms of, 381
treatment of, 383
Attenuants, simple, 151
Aura in epilepsy, 523, 524
Auricle, eczema of, 783
treament of, 783
Auriculoventricular valves, anomalies of, 396
Auscultation in pericarditis, 405
Auscultatory percussion in examination of heart, 392
Automatic movements, 517
induced, 517
treatment of, 521
rhythmic movements, 517, 519
Autumnal fever, 619

B.

Babinski's sign, 503
Bacillus lanceolatus, 472
of Eberth in typhoid fever, 619
Bacillus of Nicolaier in tetanus, 567
of tuberculosis, 606
Backhaus' Kindermilch, 142
Bacteriology of milk, 110
Balanitis, 321
treatment of, 321
Baner's rules for home modification of milk, 139
Barley jelly, 144
Barley-water, 151
Barlow's disease, 375
Basedow's disease, 555
Basilar meningitis, 575
Basophiles, 333
Bassini's operation for inguinal hernia, 236
Bath, first, of new-born, 89
hot, in acute milk infection, 204
in infantile convulsions, 509
the, in infancy, 90
Baths, cool, in measles, 734
hot, in acute diffuse nephritis, 307
in chronic gastritis, 182
in croupous pneumonia, 476, 477
in typhoid fever, 630
warm, in multiple neuritis, 564
in tetanus in new-born, 77
Bednar's aphthæ, 158
Beef broth, 145
Beef-juice, 145
Belladonna, effect of, on mother's milk, 118
Birth, changes in circulation of blood at, 22
Black measles, 731
smallpox, 682
Bladder, inflammation of, 298
position of, 30
shape of, 30
stone in, 295
causes of, 295
diagnosis of, 297
symptoms of, 296
treatment of, 298
Blennorrhagia of navel, 76
Blisters in ulcer of stomach in children, 189
Blood as a guide in diagnosis of appendicitis, 353
changes in chlorosis, 336
in circulation of, at birth, 22
in progressive pernicious anemia, 346
diseases of, 327
fetal circulation of, 21
general considerations on, 327
pathologic changes in, 330
in Hodgkin's disease, 349
in leukocythemia, 342
in pneumonia, 353

Blood, instruments used in inspection of, 334
of infants, 334
Sharpless' table on condition of the, in differentiation of diseases, 354
staining, 329
Blood-corpuscles, 327
nucleated, 332
Body, ringworm of, 777
Body-lice, 769
Boil, 763
"blind," 763
Bones, Wormian, 37
Bothriocephalus latus, 259
Brain, 38
abscess of, 589
weight of, at birth, 39
Brain-tumors, 585
Brand bath in typhoid fever, 630
Breast, 94
feeding from the, 94
contraindications to, 97
Breasts, the, in infancy, 41
Bright's disease, acute, 305
causes of, 305
complications of, 307
hot baths in, 307
pathology of, 305
prognosis of, 307
sequelæ of, 307
symptoms of, 306
treatment of, 307
urine in, 306
Broadbent's sign of pericarditis, 404
Bromids, eruption from, 745
Bronchial asthma, 458
Bronchitis, acute, 452
causes of, 452
counterirritants in, 456
diagnosis of, 455
pathology of, 452
prognosis of, 454
symptoms of, 453
treatment of, 455
asthma in, 458
chronic, 457
diagnosis of, 457
complications of, 457
treatment of, 458
emphysema in, 458
fibrinous, 458
pharyngeal catarrh in, 458
Bronchopneumonia, acute, 463
atelectasis in, 466
causes of, 463
complications of, 467
diagnosis of, 468
pathology of, 464
prognosis in, 468
sequelæ of, 467
Bronchopneumonia, acute, symptoms of, 466
treatment of, 469
chronic, 469
pathology of, 469
prognosis of, 471
symptoms of, 470
treatment of, 471
tuberculous, acute, 610
caseation in, 610
morbid anatomy of, 610
symptoms of, 611
Broth, beef, 145
chicken, 146
mutton, 145
Bruit de diable in chlorosis, 338
Bubonic plague, 738
Buhl's disease, 73
Burns, 822

C.

CACHEXIA, periosteal, 375
Calculi, renal, 316
"Calculous" appendicitis, 245
Calomel fumigations in membranous croup, 447
in cyclic vomiting, 184
Cancrum oris, 161
Capacity of lungs in infants and children, 25
of stomach at birth, 31
Caput succedaneum, 63
aspiration in, 64
causes of, 63
definition of, 63
incision in, 64
pathology of, 63
situation of, 63
synonyms of, 63
treatment of, 63
varieties of, 63
Carcinoma of kidney, 318
Cardiac aneurysm, 410
disease, chronic, physical signs of, 417
diseases, 391
classification of, 394
functional, 398
organic, 400
Carpopedal spasm, 449
spasms, 506
Cataleptic insanity, 539
Catarrh, acute gastric, 174
renal, 301
chronic gastro-intestinal, 218
intestinal, chronic, 195
desquamative, 218
pharyngeal, treatment of, 458
Catarrhal croup, 440

Catarrhal enteritis, acute, 193
chronic, 195
fever, epidemic, 700
laryngitis, 440
acute, 440
proctitis, 241
stomatitis, simple, 156
causes of, 156
symptoms of, 156
treatment of, 156
Catatonia, 539
Cautery, actual, in rectal prolapse, 238
Cecum, position of, in children, 33
Cephalhematoma, 64
causes of, 64
definition of, 64
diagnosis of, 66
pathology of, 65
prognosis of, 67
spurious, 63
subaponeurotic, 63
symptoms of, 65
synonyms of, 64
treatment of, 67
Cerebral diminution of reflex action, 503
excess of reflex action, 502
hemorrhage, 60
meningitis, simple, 570
palsies, infantile, 578
Cerebrospinal meningitis, epidemic, 706
sclerosis, 599
Certified milk, 123
Ceruminosis, 784
treatment of, 784
Chemistry of milk, 108
Chicken broth, 146
Chicken-pox. See Varicella, 687
Child, posture and general expression of, in health and disease, 42
Childhood and youth, hysteria in, 546
hysteria of, 517, 518
jaundice occurring during, 267
Children, abdomen in, shape of, 28
bath in, 90
diaphragm in, position of, 27
diet of, from second year, 147
from sixth to eighteenth month, 143
disease in, general symptomatology and diagnosis of, 41
diseases of, nervous manifestations in, 495
exercise in, 91
feeble, foods for, 793
hygiene of, 792
modified rest treatment of, 794
feeding and foods in, 94
general hygiene of, 88
genital organs in, care of, 92
heart in, position of, 23
Children, increase of weight in, 17
insanity and disturbances of the mind in, 537
and mental disorders of, treatment of, 542
lung capacity in, 25
lungs in, position of, 25
pancreas in, position of, 29
pulse-rate in, 25
respiration in, rate of, 26
type of, 26
spleen in, position of, 28
table of increase in weight of, 18
thorax in, size of, 27
thymus gland in, physiology of, 27
ulcer of stomach in, 185
Chills and fever, 689
Chloral hydrate, eruption from, 746
Chloremia, 335
Chloretone in ulcer of stomach in children, 189
Chlorosis, 335
anatomic changes in, 336
blood changes in, 336
causes of, 336
climatic change in, 339
complications in, 338
diagnosis of, 338
"humming-top" murmur in, 338
pathology of, 336
prognosis of, 339
symptoms of, 337
treatment of, 339
Cholera infantum, 200
causes of, 200
diagnosis of, 203
diet in, 204
hot bath in, 204
ice-cap in, 205
pathology of, 201
prognosis of, 203
prophylactic treatment of, 203
symptoms of, 202
treatment of attack of, 204
Chorea, 528
causes of, 529
diagnosis of, 531
habit, 535
hot bath in, 535
Huntingdon's, 537
intention, 528
minor, 528
passive, 528
pathology of, 531
postparalytic, 531, 537
Sydenham's, 528
symptoms of, 530
treatment of, 532
nutritional repair in, 532
preventive, 532

Chorea, treatment of, reeducation of coordination in, 532
rest in, 532
specific medication in, 532
Choreic insanity, 539
Chronic adenitis, 820
appendicitis, 250
bronchitis, 457
bronchopneumonia, 469
congestion of kidney, 301
croup of intestines, 218
cystitis, 299
enteritis, 195
gastritis, 178
nephritis, 309
rheumatism, 363
rhinitis, 427
Chvostek's sign in tetany, 514
Circular insanity, 538
Circulation, changes in, at birth, 22
in fetus, 21
Cirrhosis of liver, 274
Class-Gradwohl diplococcus of scarlet fever, 666
Clavus hystericus, 548
Cleft palate, 823
Climate in chronic pulmonary tuberculosis, 617
Clothing in croupous pneumonia, 478
Cocain in ulcer of stomach in children, 189
Cold applications in croupous pneumonia, 477
in enuresis, 295
in pericarditis, 406
in prolapse of anus, 240
in rheumatic fever, 360
bath in typhoid fever, 630
Cold-water injections in rectal prolapse, 238
Colic in lead paralysis, 567
intestinal, 227
causes of, 227
diagnosis of, 228
diet in, 229
enema in, 229
hot applications in, 229
symptoms of, 228
treatment of, 229
Colostrum, human, composition of, 106
Concept reflexes, 501
Condensed milk, 152
Congenital diseases of heart, 395
hernia, 235
Congestion of kidney, acute, 301
chronic, 301
of liver, 270
Constipation, chronic, 224
abdominal massage in, 226
causes of, 224
Constipation, chronic, diet in, 226
electricity in, 226
enema in, 225
symptoms of, 225
treatment of, 225
Constitutional diseases, 355
Contracted kidney, 309
Contraindications to breast feeding, 97
Convulsions, 504
in brain-tumor, 586
in lead paralysis, 567
infantile, 505
causes of, 506
table of, 511
emetics in, 510
hot bath in, 509
leeches in, 510
oxygen in, 510
prognosis of, 508
symptoms of, 505
treatment of, 509
Convulsive tic, 536
Coordinated tics, complex, 536
Cor biloculare, 396
bovinum, 416
triloculare, 396
villosum, 401
Corpuscles, blood-, 327
nucleated, 332
Corrigan pulse, 415
Cortical agenesis, 581
Coryza, 426
Cough, 450
constant, 451
dry, 451
moist, 451
paroxysmal, 451
Counterirritants in croupous pneumonia, 479
Counterirritation in infantile cerebral palsies, 584
Cow, care of the, 120
Cowpox, 685
Cow's milk, 106
percentage composition of, at different stages of milking, 112
Crab-lice, 769
Craniotabes in rachitis, 367
Cream, 116
Creams, evaporated, 153
Creasote in chronic pulmonary tuberculosis, 616
Croup, 440
catarrhal, 440
causes of, 441
diagnosis of, 442
symptoms of, 441
treatment of, 443
false, 440

Croup, membranous, 445
calomel fumigations in, 447
diagnosis of, 447
prognosis of, 447
serum treatment of, 447
symptoms of, 445
treatment of, 447
spasmodic, 440
Mitchell's treatment of, 444
treatment of, 443
true, 445
Croupous pneumonia, 471
rhinitis, 429
stomatitis, 163
symptoms of, 163
treatment of, 164
Cyclic albuminuria, 300
vomiting, 183
causes of, 183
diagnosis of, 184
diet in, 184
treatment of, 184
Cystitis, 298
causes of, 298
chronic, 299
symptoms of, 299
treatment of, 299
diet in, 299
irrigation in, 299
prognosis of, 299
symptoms of, 298
treatment of, 299

D.

DEATH, apparent, of new-born, 45
Decomposition of milk, 110
Deficiency in secretion of milk, 98
Deformities in rachitis, 368
Degeneration of intestines, amyloid, 218
of kidney, acute, 302
Delusional insanity, primary, 539
Dentition, normal and delayed, 168
Dermatitis, 743
calorica, 744
medicamentosa, 745
traumatica, 743
venenata, 744
Desquamative catarrh, intestinal, 218
nephritis, acute, 303
Development of lungs, 799
of mind, 809
of muscles, 804
of nervous system, 807
of sense organs, 795
of skin, 797
of teeth, physiology of, 168
Diabetes mellitus, 385
causes of, 385
diagnosis of, 386
Diabetes mellitus, Fehling's test in, 386
fermentation test in, 387
phenyl-hydrazin test in, 387
hygienic treatment of, 387
medicinal treatment of, 388
morbid anatomy of, 385
prognosis in, 387
symptoms of, 386
treatment of, 387
Diacetic acid in urine, 288
Diaphragm, position of, in children, 27
Diarrhea, chronic irritative, 195
dysenteric, 211
infectious, 206
mechanical, 193
simple, 193
summer, 206
Diet and hygiene of lactation, 97
in acute diffuse nephritis, 308
enteritis, 194
gastritis, 178
milk infection, 204
in chronic constipation, 226
enteritis, 197, 198
gastritis, 181
nephritis, 313
in cirrhosis of liver, 276
in congestion of liver, 271
in croupous pneumonia, 478
in cyclic vomiting, 184
in cystitis, 299
in ileocolitis, 215
in intestinal colic, 229
in jaundice of childhood, 268
in marasmus, 383
in mucous disease, 221, 222
in rachitis, 373
in rheumatic fever, 362
in scarlet fever, 678
in scorbutus, 379
in subacute milk infection, 209, 210
in typhoid fever, 628
in ulcer of stomach in children, 189
of children from second year, 147
from the sixth to the eighteenth month, 143
Diffuse nephritis, acute, 305
Digestion in infants, 32
Digestive organs, diseases of, 155
Dilatation of stomach, 191
Diphtheria, 632
albuminuria in, 638
antitoxin in, action of, 649
in limiting duration of the disease, 653
administration of, 649

Diphtheria, antitoxin in, curative dose of, 651
dosage of, 649
rules for, 652
effects of, on laryngeal form, 653
on membrane, 653
on pulse and circulation, 652
on temperature, 652
immunizing dose of, 651
influence of, on mortality records, 653
technic of applying, 648
unit of, 648
bacillus of, 632
causes of, 632
complications of, 655
constitutional treatment of, 645
diagnosis of, 639
disinfection in, 647
duration of, 638
dyspnea in, 638
extubation in, 665
incubation period of, 636
intubation in, 658
advantages of, 664
after-treatment of, 663
dangers of, 662
disadvantages of, 664
indications for, 664
method of introducing tube in, 660
prolonged use of tube in, 665
removal of tube in, 665
laryngeal, 445
intubation in, 658
local applications in, 642
membrane in, 636
mode of transmission of, 634
paralyses in, 638
pathology of, 635
prodromes of, 636
prognosis in, 640
prophylaxis of, 641
isolation in, 641
pulse in, 638
sequelæ of, 655
sick-room in care of, 641
symptoms of, 636
toluol solution in, 643
tracheotomy in, 656
after-treatment of, 658
incision in, 657
indications for, 656
treatment of, 641
varieties of, 634
Diphtheric paralysis, 565
proctitis, 242
stomatitis, 163
symptoms of, 163
Diplococcus pneumoniæ, 472
Discharges, intestinal, in infancy, 34
"rice-water," 35
Disease, Barlow's, 375
Basedow's, 555
Bright's, acute, 305
Buhl's, 73
Friedreich's, 601
Graves', 555
Hodgkin's, 349
in children, general symptomatology and diagnosis of, 41
mucous, 218
Raynaud's, 557
Winckel's, 72
Diseases characterized by jaundice, 70
constitutional, 355
in the new-born characterized by hemorrhage, 59
of blood, 327
of digestive organs, 155
of ear, 781
of endocardium, 410
of esophagus, 173
of genital organs, 319
of genito-urinary system, 284
of heart, 391
of intestines, 192
of joints, 824
of kidney, 301
of liver, 264
of mouth, 156
of nervous system, 495
of pericardium, 403
of peritoneum, 244
of rectum, 237
of respiratory organs, 422
of skin, 743
of stomach, 174
of tongue, 165
produced by septic infection, 74
Sharpless' table on condition of blood in differentiation of, 354
specific infectious, 605
Disinfection in diphtheria, 647
Disorders of speech, 437
Disseminated sclerosis, 599
Disturbances of lactation, 100
Diverticulum, Meckel's, 85
tumor, 85
Drugs, effect of, on mother's milk, 118
Dry cough, 451
Duchenne's paralysis, 81
Ductus arteriosus, 22
persistence of, 396
Dysenteric diarrhea, 211
Dysentery, 211
Dyspepsia, acute, 174
Dyspnea in diphtheria, 638
Dystrophy, 602

E.

EAR complications in scarlet fever, 675
diseases of, 781
external, diseases of, 783
foreign bodies in, 785
furuncles of, 783
foreign bodies in, treatment of, 785
internal, diseases of, 791
prognosis of, 791
symptoms of, 791
treatment of, 791
middle, acute inflammation of, 785
symptoms of, 786
suppurative inflammation of, 787
treatment of, 787
chronic catarrhal inflammation of, 790
causes of, 790
pathology of, 790
treatment of, 790
suppurative inflammation of, 788
causes of, 788
symptoms of, 788
treatment of, 789
diseases of, 785
Ecchymoma cephalæmatome, 64
Eclampsia nutans, 517, 520
rotans, 517, 520
Ecthyma, 746
treatment of, 747
Eczema, 747
acute, 752
Lassar's paste in, 753
ointments in, 753
treatment of, 752
cause of, 748
chronic, 754
arsenic in, 755
of scalp, 754
treatment of, 754
differential diagnosis of, 756
eruption in, 748
erythematosum, 756
diagnosis of, from erysipelas, 756
from syphiloderma erythematosum, 759
hygiene in, 749
local applications in, 750
of auricle, 783
treatment of, 783
papulopustulosum, diagnosis of, from scabies, 759
papulosum, 756
diagnosis of, from lichen, 758
from syphiloderma papulosum, 759
Eczema papulosum, diagnosis of, from urticaria, 756
pustulosum, diagnosis of, from favus, 758
from syphiloderma pustulosum, 760
squamosum, diagnosis of, from pityriasis capitis, 757
from pityriasis rubra, 758
from psoriasis, 757
from syphiloderma squamosum, 759
from tinea circinata, 758
treatment of, 749
vesiculosum, diagnosis of, from herpes zoster, 757
Edematous fibromata, 429
Electric reactions in infantile spinal paralysis, 592
Electricity in acute lymphadenitis, 819
in chronic constipation, 226
in infantile cerebral palsies, 584
in laryngismus stridulus, 450
in mucous disease, 224
in multiple neuritis, 565
in obstetric paralysis, 84
Emetics in acute gastritis, 176
in infantile convulsions, 510
Emphysema, pulmonary, 462, 463
treatment of, 458
Empyema, 492
diagnosis of, 493
exploring needle in, 493
prognosis of, 494
symptoms of, 493
treatment of, 494
Encysted hernia, 235
Endocardial changes in organic heart disease, 402
Endocarditis, 410
causes of, 410
clinical history of, 411
compensation in, 412
in rheumatic fever, 357
mitral regurgitation in, 413
stenosis in, 414
physical signs of, 413
rest in, 418
symptoms of, 412
treatment of, 418
Endocardium, diseases of, 410
Enema, nutrient, in ulcer of stomach in children, 189
Enemata, hot, in appendicitis, 250
in acute enteritis, 194
in chronic constipation, 225
enteritis, 199
in intestinal colic, 229
in proctitis, 243
Enteric fever, 619

Enteritis, acute, 193
causes of, 193
diet in, 194
enemata in, 194
prognosis of, 194
symptoms of, 193
treatment of, 194
catarrhal, acute, 193
chronic, 195
chronic, 195
causes of, 195
diagnosis of, 196
diet in, 197, 198
enemata in, 199
hygiene in, 197
medicinal treatment of, 199
prognosis of, 197
symptoms of, 196
treatment of, 197
Enterocolitis, 206
chronic, 195
Enuresis, 291
causes of, 292
cold applications in, 295
definition of, 291
hygiene in, 294
prognosis of, 294
treatment of, 294
Eosinophile, 327
Epidemic catarrhal fever, 700
cerebrospinal meningitis, 706
influenza, 700
Epididymitis, 323
treatment of, 323
Epilepsy, 521
anomalous, 517
aura in, 523
causes of, 522
diagnosis of, 525
focal, 522
Jacksonian, 524
masked, 524
morbid anatomy in, 522
nocturnal, 524
partial, 524
preventive treatment of, 525
prognosis of, 525
somnaic, 524
symptoms of, 522
treatment of, 525
Epileptic insanity, 539
Epispadias, 326
Erb's paralysis, 81
sign in tetany, 514
Eruption in eczema, 748
in measles, 730
in rubella, 736
in scarlet fever, 669
in typhoid fever, 624
in varicella, 688
Eruption in variola, 681
Erythema, 760
infantile, 761
intertrigo, 761
treatment of, 761
iris, 762
multiforme, 762
treatment of, 762
nodosum, 762
vaccinium, 761
varieties of, 760
variolosum, 762
Erythrocytes, 329
Esophagitis, acute, 173
treatment of, 174
Esophagus, 173
diseases of, 173
Estivo-autumnal variety of malarial fever, 691
Etat mamelloné, 179
Evaporated creams, 153
Examination of heart, 392
of milk, 113
Excoriation of navel, 76
Exercise in infancy, 91
Exercises and outings, forms of, 800
Exophthalmic goiter, 555
Exploratory needle in multiple hepatic abscess, 272
Exploring needle in empyema, 493
Expression, general, of child in health and disease, 42
Extension in acute myelitis, 597
Extubation, 665
Exudative nephritis, acute, 303
Eyes, hygiene of, after birth, 88

F.

FACIAL paralysis, 81
False croup, 440
Faradism in infantile paralysis, 594
Fat in milk, 109
estimation of, 114
Feser's lactoscope in, 115
Marchand's tube in, 115
Fatty degeneration, acute, in new-born, 73
causes of, 73
pathology of, 73
symptoms of, 73
treatment of, 73
liver, 278
"Favus cup," 778
Fears, morbid, 540
Feces, incontinence of, 241
Feeble-mindedness, 540
Feebleness in girls about the age of puberty, 811
Feeding and food of infants and children, 94

Feeding by use of modified milk of animals, 105
by wet-nurse, 104
from breast, 94
of infants prematurely born, 56
Fehling's test in diabetes mellitus, 386
Femoral hernia, 237
Fermentation test in diabetes mellitus, 387
Feser's lactoscope in estimation of fat in milk, 115
Fetal circulation, 21
heart, peculiarities of, 23
"Fettmilch," 141
Fever and ague, 689
epidemic catarrhal, 700
gastric, 174
glandular, 741
intermittent, 689
malarial, 689
rheumatic, 355
scarlet, 666
typhoid, 619
Fibrinous bronchitis, treatment of, 458
macroglossia, 166
Fibrocystic tumor of kidney, 318
Fibroma of kidney, 318
Fibromata, edematous, 429
Fibrous tumors of nose, 430
Fissure of anus, 240
Flour-ball, 144
Focal epilepsy, 522
Follicular inflammation of intestinal mucous membrane, chronic, 218
stomatitis, 157
Fontanel, anterior, 36
closure of, 36
size of, 36
posterior, 36
closure of, 36
Food in croupous pneumonia, 478
Foods containing starch, dextrin, or maltose, 149
for infants and invalids, 151
Liebig's, 150
proprietary, 149
intended to be used without milk, 150
Foramen ovale, patency of, 395
Foreign bodies in ear, 785
treatment of, 785
Formulas, milk, 103, 104
Friedreich's disease, 601
Frost bite, 744
treatment of, 744
Fulminating type of scarlet fever, 672
Functional disturbances of heart, 398
Funicular hernia, 235
Furuncle, 763
Furuncle of external ear, 783
treatment of, 784
treatment of, 763

G.

GAERTNER'S "Fettmilch," 141
Gangrene of lung, 491
oral, 161
symmetric, 557
Gangrenous stomatitis, 161
causes of, 161
cauterants in, 163
pathology of, 161
symptoms of, 161
treatment of, 163
Gastralgia, 190
causes of, 190
counterirritation in, 190
definition of, 190
treatment of, 190
Gastric catarrh, acute, 174
chronic infantile, 179
dilatation, 191
diagnosis of, 191
irrigation in, 192
pathology of, 191
symptoms of, 191
treatment of, 192
fever, 174
juice in infancy, composition of, 32
ulcer in children, 185
Gastritis, 174
acute, 174
causes of, 174
diet in, 178
emetics in, 176
lavage in, 176
pathology of, 176
prognosis of, 176
purgatives in, 176, 177
rectal injections in, 177, 178
symptoms of, 175
treatment of, 176
chronic, 178
baths in, 182
causes of, 179
diagnosis of, 181
diet in, 181
hygiene in, 181
lavage in, 183
massage in, 182
pathology of, 179
prognosis of, 181
symptoms of, 179
treatment of, 181
varieties of, 179
varieties of, 174
Gastro-adenitis, 174
Gastro-enteritis, chronic, 179

Gastro-intestinal catarrh, chronic, 218
hemorrhage, 69
causes of, 69
hot-water injections in, 70
pathology of, 70
symptoms of, 70
treatment of, 70
Gavage in infants prematurely born, 56
Gelatin-water, 151
Gelbsucht, 70
General considerations on physical development, 792
hygiene in infants and children, 88
septic infection of new-born, 74
symptomatology and diagnosis of disease in children, 41
tuberculosis, 609
Genital organs, care of, in children, 92
diseases of, 319
Genito-urinary system, diseases of, 284
German measles, 735
Gilles de la Tourette's disease, 536
Gin-drinker's liver, 274
Girls, feebleness in, about the age of puberty, 811
Glandular fever, 741
gastritis, chronic, 178
Glomerulonephritis, acute, 305
Glossitis, 167
Glottis, spasm of, 448
Glycerinized vaccine lymph, 686
Glycosuria, physiologic, 286
Goat's milk, 105
Goiter, exophthalmic, 555
symptoms of, 555
tachycardia in, 555
treatment of, 557
Von Graefe's symptom of, 556
Gonorrheal vulvovaginitis, 321
Grand mal, 523
Granular kidney, 309
Graves' disease, 555
Gray hepatization in pneumonia, 473
Green sickness, 335
Gyrospasm, 517, 520

H.

HABIT chorea, 535
movements, 535
Hair, care and treatment of, in acute infectious diseases, 741
"Hairy heart," 401
Halsted's operation for inguinal hernia, 236
Harelip, 823
Head, the, in infancy, 36
measurements of, 36
the, proportionate size of, and thorax, table of, 38.
Headache in brain-tumor, 586
sick, 559
Head-lice, 769
Head-nodding and shaking, 517, 519
Hearing in infancy, 40
Heart, anatomy of, 391
auriculoventricular valves of, anomalies of, 396
development of, 23
diseases of, 391
classification of, 394
congenital, 395
diagnosis of, 397
prognosis of, 397
symptoms of, 397
treatment of, 397
general considerations of, 391
organic, 400
pathology of, 400
examination of, 392
auscultatory percussion in, 392
phonendoscope in, 393
fetal, 23
foramen ovale of, patency of, 395
functional disturbances of, 398
causes of, 398
diagnosis of, 399
prognosis of, 400
treatment of, 400
gross anomalies of, 397
physiology of, 391
position of apex-beat of, in children, 23
valvular disease of, importance of physical signs other than murmurs in diagnosis of, 394
ventricular septum of, defects of, 396
weight of, at birth, 25
variations in, 391
Heart-beat in infants and children, rate of, 25
Hematoma of sternocleidomastoid, 67
symptoms of, 68
Hematuria, 289
causes of, 289
diagnosis of, 291
hemorrhage in, location of, 290
treatment of, 291
urine in, 289
Hemianesthesia in hysteria, 550
Hemichorea, 528
Hemicrania, 559
Hemoglobinuria, 291
acute, of new-born, 72
pathology of, 72
symptoms of, 72, 73
causes of, 291
diagnosis of, 291
treatment of, 291

Hemopericardium, 407
Hemorrhage, cerebral, 60
gastro-intestinal, 69
causes of, 69
hot-water injection in, 70
pathology of, 70
symptoms of, 70
treatment of, 70
location of, in hematuria, 290
meningeal, 60
umbilical, 69
causes of, 69
ligation in, 69
prognosis of, 69
prophylaxis in, 69
treatment of, 69
Hemorrhages from mucous surfaces, 62
causes of, 62
treatment of, 62
in new-born, 59
causes of, 59
symptoms of, 60
Hemorrhagic smallpox, 682
Hemorrhoids, 241
Hepatic abscess, acute physical signs of, 271
multiple, 272
diagnosis of, 272
exploratory needle in, 272
prognosis in, 272
treatment of, 272
congestion, 270
Hepatitis, interstitial, 274
causes of, 274
diagnosis of, 276
diet in, 276
hygiene in, 277
pathology of, 275
prognosis of, 276
symptoms of, 275
treatment of, 276
suppurative, 273
Hereditary ataxia, 601
chorea, 537
Hernia, 235
congenital, 235
diagnosis of, 236
encysted, 235
femoral, 237
funicular, 235
infantile, 235
inguinal, Bassini's operation for, 236
Halsted's operation for, 236
radical cure of, 236
truss in, 237
prognosis of, 236
symptoms of, 236
treatment of, 236
umbilical, 86
Hernia, umbilical, rubber adhesive strips in, 87
treatment of, 87
truss in, 87
Herpes iris, 762
zoster, 764
causes of, 765
diagnosis of, 765
treatment of, 765
Hip-joint disease, 825
Hives, 779
Hobnail liver, 274
Hodgkin's disease, 349
blood in, 349
causes of, 349
diagnosis of, 350
pathologic anatomy in, 349
prognosis of, 350
symptoms of, 349
treatment of, 350
Holt's method of home modification of milk, 132
Home modification of milk, 132
Hot applications in appendicitis, 250
in intestinal colic, 229
bath in acute milk infection, 204
in asphyxia neonatorum, 49
in chorea, 535
in croupous pneumonia, 476, 477
in infantile convulsions, 509
baths in acute diffuse nephritis, 307
fomentations in anuria, 286
Hot-water bag in gastralgia, 190
injections in gastro-intestinal hemorrhage, 70
"Humming-top" murmur in chlorosis, 338
Huntingdon's chorea, 537
Hydatid disease of liver, 281
diagnosis of, 282
prognosis of, 282
treatment of, 282
Hydremia, 330
Hydrocele, 323
diagnosis of, 324
in female children, 324
symptoms of, 324
treatment of, 324
Hydrocephalus, 553
acute, symptoms of, 553
chronic, symptoms of, 554
diagnosis of, 554
lumbar puncture in, 555
tapping of ventricles in, 554
treatment of, 554
Hydropericardium, 407
Hygiene, diet and, of lactation, 97
general, of infants and children, 88
in chronic gastritis, 181

Hygiene in cirrhosis of liver, 277
in rachitis, 372
Hyperæmia cerebri traumatica, 60
Hyperemia, renal, 301
Hypertrophic rhinitis, chronic, 428
Hypertrophy of tonsils, 437
Hypospadias, 325
Hypostatic pneumonia, 491
Hysteria in childhood, 517, 518
and youth, 546
amblyopia in, 550
anesthesias in, 550
ischemia in, 550
mental phenomena in, 547
opisthotonos in, 549
paralysis in, 550
paroxysm in, 548
stigmata in, 550
symptoms of, 547
tachypnea in, 551
treatment of, 551
Hysteric insanity, 539

I.

Ice-bag in appendicitis, 250
Ice-cap in acute milk infection, 205
Ice-poultice in croupous pneumonia, 477
Ictère, 70
Icterus in new born, 70
causes of, 71
symptoms of, 71
synonyms of, 70
treatment of, 71
Idiocy, 540
Ileocolitis, 211
causes of, 211
diagnosis of, 214
diet in, 215
hygiene in, 215
intestinal irrigation in, 216
pathology of, 212
preventive treatment of, 215
prognosis of, 214
symptoms of, 213
treatment of, 215
Imbecility, 540
moral, 539
Impetigo contagiosa, 766
treatment of, 767
Incontinence of feces, 241
of urine, 291
Incubation period of diphtheria, 636
of variola, 681
Incubator for infants prematurely born, 55
Indicanuria, 287
causes of, 287
test for, 287
Stokvis', 287
treatment of, 288
Indigestion, acute intestinal, 193
chronic intestinal, 195
Infancy, bath in, 90
care of mouth in, 91
exercise in, 91
hearing in, 40
sight in, 39
sleep in, 90
Infant and child, physiology of, 17
appearance of, at full term, 19
feeding, breeds of cows best adapted for, 119
gastric juice in, 32
size of, at birth, 17
temperature of, at birth, 21
variations in normal temperature in, 21
weight of, at birth, 17
Infantile atrophy, 379
cerebral palsies, 578
convulsions, 505
erythema, 761
hernia, 235
jaundice, 70
scurvy, 375
spinal paralysis, 589
Infants, blood of, 334
feeding and food in, 94
general hygiene of, 88
lung capacity in, 25
muscular exercise in, 91
prematurely born, feeding of, 56
gavage in, 56
light in, 55
management of, 54
nourishment in, 55
peptonized milk in, 58
temperature in, 54
pulse-rate in, 25
quantity of urine secreted in, 30
respiration in, rate of, 26
type of, 26
Infection, septic diseases produced by, 74
Infectious diarrhea, 206
diseases, acute, care and treatment of the hair in, 741
specific, 605
osteitis, 826
Inflammation of liver, suppurative, 273
syphilitic, 273
of middle ear, acute, 785
suppurative, 787
chronic catarrhal, 790
suppurative, 788
Inflammatory rheumatism, 355
Inflation of bowel in intussusception, 234
Influenza, epidemic, 700
bacillus of, 701
causes of, 701

Influenza, epidemic, diagnosis of, 702
mixed infections in, 701
prognosis of, 704
symptoms of, 704
treatment of, 705
Inguinal hernia, Bassini's operation for, 236
Halsted's operation for, 236
radical cure of, 236
truss in, 237
Injections, cold-water, in rectal prolapse, 238
Injuries and shock, 822
Inorganic salts in milk, 110
Insanity and disturbances of the mind in children, 537
cataleptic, 539
choreic, 539
circular or alternating, 538
delusional, primary, 539
epileptic, 539
hysteric, 539
moral, 539
treatment of, 542
Inspection in liver diseases, 265
in pericarditis, 404
Inspiration pneumonia, 45, 77
Instruments used in inspection of blood, 334
Insufficiency, mitral, 414
Insufflation, mouth-to-mouth, in asphyxia neonatorum, 52
Insular sclerosis, 599
Interlobar pleurisy, 489
Intermittent fever, 689
Internal ear, diseases of, 791
Interstitial hepatitis, 274
causes of, 274
diagnosis of, 276
diet in, 276
hygiene in, 277
pathology of, 275
prognosis of, 276
symptoms of, 275
treatment of, 276
nephritis, chronic, 309
Intestinal catarrh, chronic, 195
colic, 227
causes of, 227
diagnosis of, 228
diet in, 229
enema in, 229
hot applications in, 229
symptoms of, 228
treatment of, 229
desquamative catarrh, 218
discharges in infancy, 34
character of, 35
indigestion, acute, 193
chronic, 195
Intestinal mucous membrane, chronic follicular inflammation of, 218
obstruction, 230
by intussusception, 230
treatment of, 233
by strangulation, 230
by strictures, 230
causes of, 231
exciting, 231
predisposing, 231
diagnosis of, 253
from appendicitis, 233
from colic, 233
from enteritis, 233
from impaction of feces, 233
from volvulus, 230
mechanical, 230
pain in, 232
prognosis of, 233
symptoms of, 232
tympanites in, 232
vomiting in, 232
parasites, 254–263
tract, malformations of, 192
treatment of, 192
Intestine, atresia of, 192
large, 33
length of, in infants, 33
small, 32
length of, in infants, 32
stenosis of, 192
strangulation of, 230
stricture of, 230
Intestines, amyloid degeneration of, 218
croup of, chronic, 218
diseases of, 192
Intubation in whooping-cough, 718
of larynx in diphtheria, 658
advantages of, 664
after-treatment of, 663
dangers of, 662
disadvantages of, 664
indications for, 664
tube, method of introducing, 660
prolonged use of, 665
removal of, 665
Intussusception, 230
diagnosis of, 233
inflation of bowel in, 234
nourishment in, 234
operation for, 235
prognosis of, 233
rectal injections in, 234
symptoms of, 232
treatment of, 233
Iodids, eruption from, 746
Iodoform, effect of, on mother's milk, 118
Irrigation in acute milk infection, 204
in cystitis, 299

Irrigation in gastric dilatation, 192
in ileocolitis, 216
in subacute milk infection, 210
in ulcer of stomach in children, 189
Ischemia in hysteria, 550
Ischiorectal abscess, 241
Itch, the, 773
Ivory vaccine points, 686
Ivy-poisoning, 744

J.

Jacksonian epilepsy, 524
Jaundice, diseases characterized by, 70
infantile, 70
malignant, in new-born, 71
diagnosis of, 72
symptoms of, 72
treatment of, 72
occurring during childhood, 267
counterirritation in, 268
diet in, 268
massage in, 268
treatment of, 268
Joints, diseases of, 824
tubercular, 824

K.

Kidney, acute congestion of, 301
causes of, 301
pathology of, 301
prognosis of, 301
symptoms of, 301
treatment of, 301
chronic congestion of, 301
causes of, 301
pathology of, 301
symptoms of, 302
treatment of, 302
contracted, 309
degeneration of, acute, 302
causes of, 302
pathology of, 302
symptoms of, 302
treatment of, 302
diseases of, 301
granular, 309
lardaceous, 309
sclerosis of, 309
tuberculosis of, 317
symptoms of, 317
tumors of, 318
pathology of, 318
symptoms of, 318
waxy, 309
Kidneys, 29
in scorbutus, 377
Kidneys, position of, 29
Kindermilch, Backhaus', 142
Kopfgeschwulst, 63
Koplik's spots in measles, 730

L.

Laboratories, milk, 128
Laborde's method of artificial respiration, 50
Lacrimal glands in infancy, 40
Lactation, diet and hygiene of, 97
disturbances of, 100
Lactoscope, Feser's, in estimation of fat in milk, 115
Lactose, estimation of, in milk, 117
La Grippe, 700
Land scurvy, 772
Lardaceous kidney, 309
liver, 279
Large intestine, 33
length of, in infants, 33
Laryngeal diphtheria, 445
Laryngismus, 448
stridulus, 448
causes of, 448
diagnosis of, 449
electricity in, 450
prognosis of, 449
symptoms of, 448
treatment of, 449
Laryngitis, catarrhal, 440
pseudomembranous, 445
Laryngospasm, 448
Larynx, intubation of, in diphtheria, 658
advantages of, 664
after-treatment of, 663
dangers of, 662
disadvantages of, 664
indications for, 664
O'Dwyer's instruments for, 660
Lassar's paste in acute eczema, 753
Latent tetany, 514
Lavage, gastric, in mucous disease, 223
in acute gastritis, 176
in chronic gastritis, 183
in subacute milk infection, 210
in ulcer of stomach in children, 189
Lead paralysis, 566
Leeches in infantile convulsions, 510
Leptomeningitis, 570
Leukemia, 340
Leukocythemia, 340
blood in, 342
causes of, 340
diagnosis of, 344
lymphatic, 343
pathologic anatomy of, 341
prognosis of, 344

Leukocythemia, symptoms of, 343
treatment of, 344
Leukocytosis, 331
Lice, 769
Lichen tropicus, 767
Liebig's foods, 150
Ligation in umbilical hemorrhage, 69
Light in infants prematurely born, 55
Lime-water, 152
Lingua geographica, 167
Lipemia, 330
Liver, acute yellow atrophy of, 280
albuminous, 279
amyloid disease of, 279
cirrhosis of, 274
causes of, 274
diagnosis of, 276
diet in, 276
hygiene in, 277
pathology of, 275
symptoms of, 275
treatment of, 276
congestion of, 270
diet in, 271
prognosis of, 271
purgatives in, 271
symptoms of, 270
treatment of, 271
diseases of, 264
inspection in, 265
palpation in, 266
percussion in, 266
fatty, 278
symptoms of, 279
treatment of, 279
gin-drinker's, 274
hobnail, 274
hydatid disease of, 281
lardaceous, 279
sclerosis of, 274
scrofulous, 279
suppurative inflammation of, 273
symptoms of, 273
syphilitic inflammation of, 273
diagnosis of, 273
symptoms of, 243
waxy, 279
Lobar pneumonia, 471
Lockjaw, 567
Lumbar puncture in hydrocephalus, 555
Lung, gangrene of, 491
Lungs, capacity of, in infants and children, 25
development of, 799
position of, in children, 25
tuberculosis of, 610
Lymphadenitis, 818
acute, 818
causes of, 818
cold applications in, 819
Lymphadenitis, acute, diagnosis of, 819
electricity in, 819
incision in, 819
pathology of, 818
prognosis of, 819
symptoms of, 819
treatment of, 819
local, 819
retropharyngeal, 431
Lymphangitis, 818
Lymphatic anemia, 349
leukocythemia, 343
Lymphocyte, 327

M.

MACROCYTES, 329
Macrocythemia, 331
Macroglossia, 165
fibrinous, 166
symptoms of, 166
treatment of, 166
Malarial fever, 689
causes of, 690
diagnosis of, 698
estivo-autumnal variety of, 691
pathologic anatomy of, 695
pathology of, 692
prognosis of, 698
prophylaxis of, 698
symptoms of, 695
treatment of, 698
types of, 691
quartan, 691
quotidian, 691
tertian, 691
variations of, 691
parasites, 692
Mannaberg's table of, 696
Malformations of intestinal tract, 192
Malignant jaundice in new-born, 71
polyadenitis, 738
purpuric fever, 706
Management of infants prematurely born, 54
Mania, 538
Mannaberg's table of malarial parasites, 696
"Mappy" tongue, 167
Marasmus, 379
causes of, 380
diagnosis of, 382
diet in, 383
pathology of, 381
prognosis of, 383
symptoms of, 381
treatment of, 383
Marchand's tube in estimation of fat in milk, 115
Marsh fever, 689

Masked epilepsy, 524
Massage, abdominal, in chronic constipation, 226
in acute myelitis, 598
in chronic gastritis, 182
in infantile cerebral palsies, 584
spinal paralysis, 594
in jaundice of childhood, 268
in mucous disease, 224
in multiple neuritis, 565
in obstetric paralysis, 84
"Mast-cell," 333
Mastitis in new-born, 80
hot fomentations in, 80
McBurney's point in appendicitis, 247
McCollom's types of scarlet fever, 672
Measles, 729
black, 731
causes of, 730
complications of, 733
cool baths in, 734
diagnosis of, 732
eruption in, 730
German, 735
incubation period in, 729
Koplik's spots in, 730
Muenier's sign of, 730
pathology of, 732
prophylaxis of, 733
sequelæ of, 732, 733
sick-room in, 733
symptoms of, 730
treatment of, 733
Measurements of head in infancy, 36
Mechanical diarrhea, 193
Meckel's diverticulum, 85
Meconium, 34
Megaloblast, 332
Megalocytes, 329
Megrim, 559
Melancholia, 538
Melanemia, 331
Melena in new-born, 79
causes of, 79
definition of, 79
symptoms of, 79
treatment of, 79
Membranous croup, 445
proctitis, 242
rhinitis, 429
Meningeal hemorrhage, 60
Meningitis, basilar, 575
cerebral, simple, 570
causes of, 570
course of, 573
diagnosis of, 573
morbid anatomy of, 572
prognosis of, 573
symptoms of, 571
tache cérébrale in, 572
Meningitis, cerebral, simple, treatment of, 574
cerebrospinal, epidemic, 706
causes of, 707
diagnosis of, 709
pathology of, 707
prognosis of, 709
symptoms of, 707
treatment of, 709
plastic, 572
posterior basic, simple, 574
purulent, 570, 572
tubercular, 575
causes of, 575
course of, 577
diagnosis of, 577
pathology of, 577
prognosis of, 577
symptoms of, 575
treatment of, 577
Mental disorders of children, treatment of, 542
Mercurial stomatitis, 164
symptoms of, 165
treatment of, 165
Mercury, effect of, on mother's milk, 118
Microblast, 332
Microcytes, 329
Microcythemia, 331
Microglossia, 165
Microscopic examination of milk, 114
Micturition, physiology of, 292
Migraine, 559
causes of, 559
pathology of, 560
symptoms of, 559
treatment of, 560
visual disturbances in, 560
Miliaria, 767
alba, 767
crystallina, 767
diagnosis of, 768
differential diagnosis of, 768
papulosa, 768
prognosis of, 768
rubra, 767
et vesiculosa, 767
treatment of, 768
Milk, ass's, 105
bacteriology of, 110
care of, 121
certified, 123
chemistry of, 108
condensed, 152
cow's, 106
percentage composition of, at different stages of milking, 112
cream in, 116
decomposition of, 110

Milk, deficiency in secretion of, 98
examination of, 113
microscopic, 114
fat in, 109
estimation of, 114
Feser's lactoscope in, 115
Marchand's tube in, 115
formulas, 103, 104
Rotch's, for infants prematurely born, 58
goat's, 105
home modification of, 132
Baner's rules for, 139
Holt's method of, 132
Rotch's method of, 134
use of the Materna in, 141
Westcott's method of, 137
human, percentage of solids in, 113
infection, acute, 200
causes of, 200
diagnosis of, 203
diet in, 204
hot bath in, 204
ice-cap in, 205
irrigations in, 204
pathology of, 201
prognosis of, 203
prophylactic treatment of, 203
symptoms of, 202
treatment of attack, 204
subacute, 206
causes of, 207
diagnosis of, 209
diet in, 209, 210
hygiene in, 210
irrigations in, 210
lavage in, 210
pathology of, 208
prognosis of, 209
symptoms of, 208
tonics in, 211
treatment of, 209
inorganic salts in, 110
laboratories, 128
lactose in, estimation of, 117
modified, 126
of animals, feeding by use of, 105
mother's, effect of drugs on, 118
Pasteurization of, 125
peptonized, in infants prematurely born, 58
predigestion of, 142
proteids in, 109
estimation of, 118
reaction of, 110
salts of, estimation of, 117
sterilization of, 123
sugar in, 109
Milk, supervision of production of, by boards of health, 121
Milk-teeth, 168, 169
Millet, 159
Mind, development of, 809
Mitchell's treatment of croup, 444
Mitral insufficiency, 413
obstruction, 414
regurgitation, 413
physical signs of, 413
stenosis, 414
physical signs of, 414
Modification of reflexes, 502
Modified milk, 126
Moral imbecility, 539
insanity, 539
Morbid fears, 540
Morbilli, 729
Morphin, effect of, on mother's milk, 118
in infantile convulsions, 510
in ulcer of stomach in children, 189
Morrow's differential points between syphilis and scrofulous skin-lesions, 722
Motor excitements, 504
Mouth, 155
aphthous sore, 157
care of the, in infancy, 91
diseases of the, 156
Movements, automatic, 517
induced, 517
rhythmic, 517, 519
habit, 535
Mucous disease, 218
causes of, 218
diagnosis of, 220
diet in, 221, 222
electricity in, 224
gastric lavage in, 223
hygiene in, 221
massage in, 224
pathology of, 219
prognosis of, 221
salines in, 223
symptoms of, 219
tonics in, 224
treatment of, 221
polypi of nose, 429
surfaces, hemorrhages from, 62
Muenier's sign of measles, 730
Muguet, 159
Multiple hepatic abscess, 272
neuritis, 561
Mumps, 711
causes of, 711
complications in, 711
diagnosis of, 711
prognosis of, 712
symptoms of, 711
treatment of, 712

New-born, [illegible] of, causes of, 71
symptoms of, 71
[illegible] of, 70
treatment of, 71
malignant [illegible] in, 71
diagnosis of, 72
symptoms of, 72
treatment of, 72
[illegible] in, 50
[illegible] in, 70
[illegible] in, 529
[illegible] in, 70
cause of, 70
symptoms of, 71
warm baths in, 77
Night-terrors, 528
Nine-day fits, 70
Nocturnal epilepsy, 524
Noma, 101
Normal leucocyte, 108
Normoblast, 332
Nourishment in infants prematurely born, 55
Nucleated corpuscles, 332
Nursery, the, 42
Nutrient enema in ulcer of stomach in children, 180

O.

Artificial, 144
Oatmeal-water, 151
Obstetric paralysis, 81
causes of, 81
curative treatment of, 84
duration of, 81
diagnosis of, 83
electricity in, 84
massage in, 84
prognosis of, 83
prophylactic treatment of, 84
symptoms of, 82
treatment of, 84
Obstruction, intestinal, 230
mitral, 414
Ocular neuritis in lead paralysis, 567
O'Dwyer's instruments for intubation of larynx in diphtheria, 660
Oidium albicans in parasitic stomatitis, 150
Oligemia, 330
Oligocythemia, 330
Oligocythemia, 330
Omphalitis, 70
causes of, 76
treatment of, 76
Omphalomesenteric duct, persistence of, 85
Operation for intussusception, 235
in rectal prolapse, 238
Operative treatment of appendicitis, 251
Ophthalmia in new-born, 520
causes of, 527
prophylaxis of, 527
symptoms of, 527
treatment of, 527
Opisthotonos in hysteria, 549
Opium, effect of, in mother's milk, 118
eruption from, 740
Optic neuritis in brain-tumor, 556
Oral gangrene, 101
Orchitis, 522
in mumps, 711
treatment of, 522
Osteitis, infectious, 520
Osteomyelitis, 520
Otitis media acuta, 785
chronic catarrhal, 790
suppurative, 788
suppurative, 787
treatment of, 787
Outings, exercises and, forms of, 500
Ovarian tumors in children, 525
Oxygen in infantile convulsions, 510
Oxyuris vermicularis, 254
mode of infection by, 255
treatment of, 255
Ozena, 428

P.

Pack, cold, in croupous pneumonia, 477
hot, in acute diffuse nephritis, 307, 308
Pain in appendicitis, 247
in intestinal obstruction, 232
Palate, cleft, 823
Palpation in liver diseases, 266
in pericarditis, 404
Palsies, cerebral, infantile, 578
causes of, 579
counterirritation in, 584
description of, 579
differential diagnosis of, 583
diplegic, 578, 580
effects of, summary of, 582
electricity in, 584
hemiplegic, 578, 579
massage in, 584
monoplegic, 578, 580
morbid anatomy of, 581
paraplegic, 578, 580
pathology of, 581
prognosis of, 583
spastic, 578
symptoms of, 579
treatment of, 583
Pancreas, 20
situation of, 29

Muscle reflexes, 501
Muscles, development of, 804
Muscular atrophies, progressive, 602
pains in lead paralysis, 567
paralysis, pseudohypertrophic, 603
rheumatism, 362
sense, 504
Mutton broth, 145
Myelitis, acute, 594
causes of, 594
course of, 595
extension in, 597
massage in, 598
pathology of, 597
prognosis of, 597
symptoms of, 595
treatment of, 597
Myelocytes, 333
Myocarditis, 401, 408
acute suppurative, 410
causes of, 409
diagnosis of, 410
pathology of, 409
sequelæ of, 410
symptoms of, 409
treatment of, 410
Myocardium, affections of, 407
causes of, 407
symptoms of, 407
Myopathies, 602
Myxedema, 558
cause of, 558
symptoms of, 558

N.

Nasal fibrous tumors, 430
Navel, excoriation of, 76
inflammation of, 76
Nephritis, chronic, 309
causes of, 309
diagnosis of, 312
diet in, 313
hot baths in, 313
pathology of, 309
prognosis of, 312
symptoms of, 310
treatment of, 313
desquamative, acute, 303
diffuse, acute, 305
causes of, 305
complications in, 307
diet in, 308
hot baths in, 307
pathology of, 305
prognosis in, 307
sequelæ in, 307
symptoms of, 306
treatment of, 307
urine in, 306
Nephritis, diffuse, acute, venesection in, 308
chronic, without exudation, 309
exudative, acute, 303
causes of, 303
pathology of, 303
prognosis of, 305
symptoms of, 304
interstitial, chronic, 309
parenchymatous, acute, 303
chronic, 309
septic interstitial, acute, 303
tubular, acute, 303
Nervous manifestations in diseases of children, 495
system, development of, 807
diseases of, 495
Nettle-rash, 779
Neuritis, 561
alcoholic, 562
multiple, 561
causes of, 561
diagnosis of, 564
electricity in, 565
massage in, 565
morbid anatomy of, 562
symptoms of, 562
treatment of, 564
warm baths in, 564
wrist-drop in, 563
optic, in brain-tumor, 586
Neuron, the, 499
Neutrophile, 329
New-born, acute fatty degeneration in, 73
cause of, 73
pathology of, 73
symptoms of, 73
treatment of, 73
hemoglobinuria of, 72
apoplexy in, 60
causes of, 60
definition of, 60
pathology of, 60
symptoms of, 61
treatment of, 62
apparent death of, 45
diseases in, characterized by hemorrhage, 59
eyes in, care of, 88
first bath of, 89
general septic infection of, 74
preventive treatment of, 75
symptoms of, 74
treatment of, 75
hemorrhages in, 59
causes of, 59
symptoms of, 60
icterus of, 70

New-born, icterus of, causes of, 71
symptoms of, 71
synonyms of, 70
treatment of, 71
malignant jaundice in, 71
diagnosis of, 72
symptoms of, 72
treatment of, 72
mastitis in, 80
melena in, 79
ophthalmia in, 826
tetanus in, 76
cause of, 76
symptoms of, 77
warm baths in, 77
Night-terrors, 538
"Nine-day fits," 76
Nocturnal epilepsy, 524
Noma, 161
Normal dentition, 168
Normoblast, 332
Nourishment in infants prematurely born, 55
Nucleated corpuscles, 332
Nursery, the, 92
Nutrient enema in ulcer of stomach in children, 189

O.

Oat jelly, 144
Oatmeal-water, 151
Obstetric paralysis, 81
causes of, 81
curative treatment of, 84
definition of, 81
diagnosis of, 83
electricity in, 84
massage in, 84
prognosis of, 83
prophylactic treatment of, 84
symptoms of, 82
treatment of, 84
Obstruction, intestinal, 230
mitral, 414
Ocular neuritis in lead paralysis, 567
O'Dwyer's instruments for intubation of larynx in diphtheria, 660
Oïdium albicans in parasitic stomatitis, 159
Oligemia, 330
Oligochromemia, 330
Oligocythemia, 330
Omphalitis, 76
causes of, 76
treatment of, 76
Omphalomesenteric duct, persistence of, 85
Operation for intussusception, 235
in rectal prolapse, 238
Operative treatment of appendicitis, 251
Ophthalmia in new-born, 826
causes of, 827
prophylaxis of, 827
symptoms of, 827
treatment of, 827
Opisthotonos in hysteria, 549
Opium, effect of, on mother's milk, 118
eruption from, 746
Optic neuritis in brain-tumor, 586
Oral gangrene, 161
Orchitis, 322
in mumps, 711
treatment of, 322
Osteitis, infectious, 826
Osteomyelitis, 826
Otitis media acuta, 785
chronic catarrhal, 790
suppurative, 788
suppurative, 787
treatment of, 787
Outings, exercises and, forms of, 800
Ovarian tumors in children, 325
Oxygen in infantile convulsions, 510
Oxyuris vermicularis, 254
mode of infection by, 255
treatment of, 255
Ozena, 428

P.

Pack, cold, in croupous pneumonia, 477
hot, in acute diffuse nephritis, 307, 308
Pain in appendicitis, 247
in intestinal obstruction, 232
Palate, cleft, 823
Palpation in liver diseases, 266
in pericarditis, 404
Palsies, cerebral, infantile, 578
causes of, 579
counterirritation in, 584
description of, 579
differential diagnosis of, 583
diplegic, 578, 580
effects of, summary of, 582
electricity in, 584
hemiplegic, 578, 579
massage in, 584
monoplegic, 578, 580
morbid anatomy of, 581
paraplegic, 578, 580
pathology of, 581
prognosis of, 583
spastic, 578
symptoms of, 579
treatment of, 583
Pancreas, 29
situation of, 29

Panotitis, 791
prognosis of, 791
Paquelin cautery in prolapse of anus, 240
Paracentesis in pericarditis, 407
Paralyses in lead paralysis, 566
Paralysis, diphtheric, 565
prognosis of, 565
treatment of, 566
Duchenne's, 81
Erb's, 81
facial, 81
in hysteria, 550
infantile spinal, 589
causes of, 589
diagnosis of, 590
from acute cerebral palsy, 591
from meningitis, 590
from peripheral neuritis, 591
electric reactions in, 592
faradism in, 594
massage in, 594
pathology of, 590
prognosis of, 593
reflexes in, 593
symptoms of, 591
treatment of, 594
lead, 566
diagnosis of, 566
colic and muscular pains in, 567
convulsions in, 567
ocular neuritis in, 567
paralyses in, 566
treatment of, 567
muscular, pseudohypertrophic, 603
diagnosis of, 604
pathology of, 603
prognosis of, 604
symptoms of, 603
treatment of, 604
obstetric, 81
causes of, 81
curative treatment of, 84
diagnosis of, 83
electricity in, 84
massage in, 84
prognosis of, 83
prophylactic treatment of, 84
symptoms of, 82
treatment of, 84
of central origin following labor, 82
Paranoia, 539
Paraphimosis, 320
treatment of, 320
Parasites, intestinal, 254–263
Parasitic stomatitis, 159
causes of, 159
curative treatment of, 160
Parasitic stomatitis, oïdium albicans as cause of, 159
prophylactic treatment of, 160
symptoms of, 160
treatment of, 160
Parenchymatous nephritis, acute, 303
chronic, 309
Paretic dementia, 540
Parotitis, specific, 711
Paroxysm in hysteria, 548
Partial epilepsy, 524
Pasteurization of milk, 125
Patency of foramen ovale, 395
Pediculosis, 769
treatment of, 769
Peliosis rheumatica, 772
Peptonized milk in infants prematurely born, 58
Percussion in liver diseases, 266
in pericarditis, 405
Pericarditis, 401, 403
auscultation in, 405
Broadbent's sign of, 404
cold applications in, 406
diagnosis of, 405
etiology of, 403
hot applications in, 406
in rheumatic fever, 357
inspection in, 404
palpation in, 404
paracentesis in, 407
percussion in, 405
physical signs of, 404
plastic, 401
prognosis of, 406
symptoms of, 403
treatment of, 406
Pericardium, diseases of, 403
Perinephritis, 314
causes of, 314
diagnosis of, 315
from inflammation of hip joint, 315
from psoas abscess, 315
pathology of, 314
prognosis of, 315
symptoms of, 314
treatment of, 315
Periosteal cachexia, 375
Peritoneum, diseases of, 244
tuberculosis of, 252
diagnosis of, 253
pathology of, 252
prognosis of, 253
symptoms of, 253
treatment of, 254
Pernicious anemia, progressive, 345
blood changes in, 346
causes of, 345
diagnosis of, 348

Pernicious anemia, progressive, morbid anatomy of, 345
prognosis in, 348
symptoms of, 347
treatment of, 348
Persistence of ductus arteriosus, 396
of omphalomesenteric duct, 85
Pertussis, 713
Petit mal, 523
Pharyngeal catarrh, treatment of, 458
Pharyngitis, acute, 430
Phenyl-hydrazin test in diabetes mellitus, 387
Phimosis, 319
symptoms of, 319
treatment of, 319
Phlebitis, rheumatic, 363
Phobias, 540
Physical development, general considerations on, 792
signs other than murmurs in diagnosis of valvular diseases of heart, importance of, 394
Physiologic albuminuria, 300
glycosuria, 286
Physiology of development of teeth, 168
of heart, 391
of infant and child, 17
of micturition, 292
Pigeon-breast, 28
"Pinctosis," 347
Pin-worms, 254
Pityriasis rosea, 770
Plague, bubonic, 738
causes of, 739
diagnosis of, 740
symptoms of, 739
treatment of, 740
types of, 739
Plastic meningitis, 572
Plethora, 330
Pleurisy, 483
causes of, 483
diagnosis of, 487
interlobar, 489
causes of, 489
diagnosis of, 490
physical signs of, 489
pathology of, 484
physical signs of, 486
prognosis of, 486
symptoms of, 485
treatment of, 488
Pleuritis, purulent, 492
Pleuropneumonia, 490
diagnosis of, 491
prognosis of, 491
Pleurothotonos in pericarditis, 404
Pneumonia, croupous, 471
bacillus of, 472
Pneumonia, croupous, causes of, 472
chill in, 473
complications of, 475
diagnosis of, 475
from meningitis, 475
gangrene of lung in, treatment of, 482
hernia of lung in, treatment of, 482
pathology of, 472
stage of engorgement in, 472
of gray hepatization in, 473
of red hepatization in, 472
of resolution in, 473
physical signs of, 474
prognosis of, 475
pulmonary edema in, treatment of, 482
symptoms of, 473
treatment of, 476
bathing in, 476
clothing in, 478
cold applications in, 477
pack in, 477
counterirritants in, 479
food in, 478
hot bath in, 476, 477
hygiene in, 476
ice poultice in, 477
medicines in, 480
poultices in, 479
stimulants in, 478
hypostatic, 491
inspiration, 77
the blood in, 353
Pneumopericardium, 407
Poikilocytosis, 332
Poliomyelitis anterior acuta, 589
Polyadenitis, malignant, 738
Polychromatophilia, 332
Polyneuritis, 561
Polypi, mucous, of nose, 429
rectal, 238
umbilical, 84
Polyuria, 286
causes of, 286
diagnosis of, 286
Posterior fontanel, 36
closure of, 36
Postparalytic chorea, 531, 537
Posture of child in health and disease, 42
Potassium iodid, effect of, on mother's milk, 118
Pott's disease, 826
Poultices in croupous pneumonia, 479
Predigestion of milk, 142

Prepuce, adherent, 319
treatment of, 319
Pressure palsy in rachitis, 368
Prickly heat, 767
Primary anemia, simple, 339
anemias, 335
Proctitis, 241
catarrhal, 241
causes of, 242
diphtheric, 242
enemata in, 243
membranous, 242
symptoms of, 242
treatment of, 243
ulcerative, 242
Progressive muscular atrophies, 602
Prolapse of anus, 239
of rectum, 237
Proprietary foods, 149
intended to be used without milk, 150
Prostatic gland in children, 30
Proteids in milk, 109
estimation of, 118
Pseudohypertrophic muscular paralysis, 603
Pseudoleukemia, 349
splenic, 340
Pseudoleukocythemia infantum, 345
Pseudomembranous laryngitis, 445
Psoriasis, 770
prognosis of, 771
treatment of, 771
Psychic tic, 536
Psychoses, transitory, 538
Ptyalism, 164
causes of, 164
symptoms of, 165
treatment of, 165
Pulmonary artery, atresia of, 396
stenosis of, 396
collapse, 491
emphysema, 462
treatment of, 463
gangrene, 491
tuberculosis, chronic, 612
Pulse, Corrigan, 415
water-hammer, 415
Pulse-rate in infants and children, 25
normal, 392
Pulsus celer, 413
Purgatives in congestion of liver, 271
Purpura, 771
hæmorrhagica, 772
treatment of, 773
rheumatica, 772
prognosis of, 772
treatment of, 772
simplex, 771
Purpuric fever, malignant, 706
Purulent meningitis, 570, 572
rhinitis, 428
Pyelitis, 315
causes of, 315
diagnosis of, 316
pathology of, 316
symptoms of, 316
treatment of, 316
Pyloric hypertrophy with stenosis, 184
symptoms of, 184
treatment of, 185
Pyuria, 289

Q.

QUARTAN type of malarial fever, 691
Quinin eruption, 746
rectal injections of, in ileocolitis, 217
Quotidian type of malarial fever, 691

R.

RACHITIC asthma, 448
"rosary," 369
Rachitis, 364
causes of, 365
craniotabes in, 367
deformities in, 368
diet in, 373
hygiene in, 372
medicinal treatment of, 374
pathology of, 371
pressure palsy in, 368
preventive treatment of, 372
prognosis of, 372
symptoms of, general, 366
treatment of, 372
Ranula, 167
treatment of, 167
Rash in scarlet fever, 669
Raynaud's disease, 557
causes of, 558
prognosis of, 558
symptoms of, 558
treatment of, 558
Reaction of milk, 110
Rectal injection in intussusception, 234
polypi, 238
Rectum, diseases of, 237
inflammation of, 241
prolapse of, 237
actual cautery in, 238
causes of, 237
cold-water injections in, 238
operation in, 238
symptoms of, 238
treatment of, 238
"Red gum," 768
hepatization, stage of, in croupous pneumonia, 472

Reflex action, diminution of, 503
cerebral, 503
excess of, 502
cerebral, 502
spinal, 503
Reflexes, concept, 501
in infantile spinal paralysis, 593
modification of, 502
muscle, 501
significance of, 502
skin, 501
somatic, 501
their physiology and significance, 500
Regurgitation, aortic, 415
mitral, 413
Renal calculi, 316
symptoms of, 317
catarrh, acute, 301
hyperemia, 301
Respiration, artificial, Laborde's method of, 50
Schultze's method of, 50
Sylvester's method of, 50
rate of, in infants and children, 26
type of, in infants and children, 26
Respiratory organs, 422
upper, diseases of, causes of, 422
pathology of, 422
Rest in endocarditis, 418
Retropharyngeal abscess, 431
causes of, 431
diagnosis of, 432
from caries of cervical vertebræ, 433
prognosis of, 432
symptoms of, 432
treatment of, 432
lymphadenitis, 431
Rheumatic fever, 355
causes of, 355
cold applications in, 360
complications in, 357
course of, 359
diagnosis of, 358
diet in, 362
duration of, 359
endocarditis in, 357
morbid anatomy of, 356
pericarditis in, 357
preventive treatment of, 362
prognosis of, 359
salicylates in, 360, 361
symptoms of, 356
treatment of, 360
urine in, 356
pharyngitis, 431
phlebitis, 363
Rheumatism, acute, 355
Rheumatism, acute articular, 355
chronic, 363
inflammatory, 355
muscular, 362
Rhinitis, acute, 426
treatment of, 426
atrophic, 428
chronic, 427
hypertrophic, 427
simple, 427
croupous, 429
membranous, 429
purulent, 428
syphilitic, 429
Rhythmic movements, automatic, 517, 519
"Rice-water" discharges, 35
Rickets, 364
Ringworm of body, 777
of scalp, 775
Risus sardonicus in tetanus, 77
Romberg's symptom in hereditary ataxia, 601
Roseola, 761
vaccinia, 761
Rotch's method of home modification of milk, 134
milk formulas for infants prematurely born, 58
Rötheln, 735
Round worms, 256
diagnosis of, 258
symptoms of, 257
treatment of, 258
Rubella, 735
causes of, 735
diagnosis of, 737
from measles, 737
from scarlet fever, 737
from varicella, 737
from variola, 737
eruption in, 736
incubation in, 736
prognosis of, 736
symptoms of, 736
treatment of, 737
Rubeola, 729

S.

Salaam convulsions, 517, 520
Salicylates in rheumatic fever, 360, 361
Saline cathartics, effect of, on mother's milk, 118
Salines in appendicitis, 250
in cirrhosis of liver, 277
Salivary glands in infancy, 40
Salts, inorganic, in milk, 110
of milk, estimation of, 117
Sarcoma of kidney, 318

Scabies, 773
diagnosis of, 773
treatment of, 773
Scalp, ringworm of, 775
Scarlatina, 666
surgical, 672
Scarlet fever, 666
adenitis in, 668
causes of, 666
Class-Gradwohl diplococcus of, 666
complications of, 674
ear, 675
heart, 676
nervous, 676
desquamation in, 670
"collarette" in, 670
diagnosis of, 673
diet in, 678
ear complications in, 675
treatment of, 675
fulminating type of, 672
hygiene in, 677
preventive treatment of, 677
prognosis of, 677
rash in, 669
duration of, 670
relapses in, 676
"strawberry tongue" in, 669
symptoms of, 668
treatment of, 677
types of, 671
McCollom's, 672
urine in, 669
albumin in, 673
Schultze's method of treating asphyxia neonatorum, 50
Sclerema, 78
causes of, 78
definition of, 78
diagnosis of, 79
pathology of, 78
prognosis of, 79
symptoms of, 78
treatment of, 79
Sclerosis, disseminated, 599
causes of, 599
medicinal treatment of, 601
pathology of, 600
prognosis of, 600
symptoms of, 599
"scanning speech" in, 599
treatment of, 600
of kidney, 309
of liver, 274
Scorbutus, 375
causes of, 375
diagnosis of, 378
differential, 378
Scorbutus, diet in, 379
duration of, 378
heart and circulatory apparatus in, 377
kidneys in, 377
pathology of, 375
prognosis of, 378
symptoms of, 376
"therapeutic test" of, 379
treatment of, 379
Scrofulous liver, 279
Scurvy, infantile, 375
land, 772
Sebaceous glands in infancy, 41
Seborrhea, 774
Secondary anemia, 350
Sense organs, development of, 795
Septic infection, diseases produced by, 74
general, of new-born, 74
preventive treatment of, 75
symptoms of, 74
treatment of, 75
interstitial nephritis, acute, 303
Serum-test for typhoid infection, 625
Sharpless' table on condition of blood in differentiation of diseases, 354
Shingles, 764
Shock, 823
injuries and, 822
Sick headache, 559
Sight in infancy, 39
Sigmoid flexure in children, 34
Significance of reflexes, 502
Simple atrophy, 379
cerebral meningitis, 570
chronic rhinitis, 427
diarrhea, 193
Size of infant at birth, 17
Skin, development of, 797
diseases of, 743
inflammation of, 743
reflexes, 501
Sleep in infancy, 90
Small intestine, 32
length of, in infant, 32
Smallpox. See Variola, 680
hemorrhagic, 682
Snuffles, 424
Sodium chlorid injections in acute gastritis, 178
Solids, percentage of, in human milk, 113
Somatic reflexes, 501
Somnaic epilepsy, 524
Soor, 159
Spasm of glottis, 448
Spasmodic asthma, 458
croup, 440

Spasms, habit, 536
in tetany, 513
Specific infectious diseases, 605
parotitis, 711
Speech, disorders of, 437
Spermatic cord, torsion of, 325
Spinal excess of reflex action, 503
paralysis, infantile, 589
Spleen, position of, in children, 28
Splenic anemia, 340
pseudoleukemia, 340
Spondylitis, 826
Sponge-baths in chronic gastritis, 182
Spotted fever, 706
Sprue, 159
Spurious cephalhematoma, 63
Stenosis, mitral, 414
of aorta, 396
of intestine, 192
of pulmonary artery, 396
Sterilization of milk, 123
Sternocleidomastoid, hematoma of, 67
symptoms of, 68
Stigmata in hysteria, 550
Stimulants in croupous pneumonia, 478
Stokvis' test for indicanuria, 287
precaution in, 288
Stomach, 31
capacity of, at birth, 31
dilatation of, 191
diagnosis of, 191
irrigation in, 192
pathology of, 191
symptoms of, 191
treatment of, 192
diseases of, 174
in infancy, 31
inflammation of, acute, 174
chronic, 178
position of, in infants, 31
ulcer of, in children, 185
blisters in, 189
causes of, 186
diet in, 189
irrigation in, 189
nutrient enema in, 189
symptoms of, 187
treatment of, 188
Stomatitis, 156
aphthous, 157
causes of, 157
cleansing solutions in, 157, 158
laxatives in, 157
treatment of, 157
croupous, 163
diphtheric, 163
treatment of, 164
follicular, 157
gangrenous, 161
causes of, 161
Stomatitis, gangrenous, cauterants in, 163
pathology of, 161
symptoms of, 161
treatment of, 163
mercurial, 164
mycosa, 159
causes of, 159
curative treatment of, 160
oïdium albicans as cause of, 159
prophylactic treatment of, 160
symptoms of, 160
treatment of, 160
parasitic, 159
simple catarrhal, 156
causes of, 156
symptoms of, 156
treatment of, 156
syphilitic, 164
ulcerative, 158
causes of, 158
hygiene in, 159
symptoms of, 158
treatment of, 159
varieties of, 156
vesicular, 157
Stone in bladder, 295
causes of, 295
diagnosis of, 297
symptoms of, 296
treatment of, 298
Stramonium bromid in ulcer of stomach in children, 189
Strangulation of intestine, 230
"Strawberry tongue" of scarlet fever, 669
Strophulus, 768
St. Vitus' dance, 528
Subacute milk infection, 206
Subaponeurotic cephalhematoma, 63
Sudamina, 767
Suffocative catarrh, 467
Sugar in milk, 109
Summer complaint, 206
diarrhea, 206
Supplementary head, 63
Suppurative inflammation of liver, 273
myocarditis, acute, 410
Surgical scarlatina, 672
Swamp fever, 689
Sweat-glands in infancy, 40
Sydenham's chorea, 528
Sylvester's method of treating asphyxia neonatorum, 50
Symmetric gangrene, 557
Symptomatology, general, and diagnosis of disease in children, 41
Synovitis, 824
Syphilis, 718
bone-lesions in, 723
diagnosis of, 722

Syphilis, diagnosis of, from rachitic bone-lesions, 724
from scrofulous lesions of skin, 722
early manifestations of, 719
internal medication in, 727
inunctions in, 726
late manifestations of, 724
prognosis of, 724
symptoms of, 719
treatment of, 726
Syphilitic dactylitis, 724
inflammation of liver, 273
rhinitis, 429
stomatitis, 164
teeth, 725

T.

TABLE of causes of infantile convulsions, 511
of increase in weight of children, 18
Sharpless', on condition of blood in differentiation of diseases, 354
Tache cérébrale in simple cerebral meningitis, 572
Tachycardia, 398
in goiter, 555
Tachypnea in hysteria, 551
Tænia mediocanellata, 259
solium, 259
Tapeworm, 259
treatment of, 262
Tapping of ventricles in hydrocephalus, 554
Teeth, milk-, 168, 169
physiology of development of, 168
syphilitic, 725
Temperature in appendicitis, 247
in infants prematurely born, 54
normal, variations of, in infants, 21
of infant at birth, 21
Tenia, 259
development of, history of, 260
diagnosis of, 259
infection by, mode of, 260
symptoms of, 262
treatment of, 262
Tertian type of malarial fever, 691
Testicle, inflammation of, 322
tubercular disease of, 322
treatment of, 323
undescended, 325
treatment of, 325
Testicles, the, in infancy, 41
Tetanus, 567
bacillus of Nicolaier in, 567
causes of, 567
diagnosis of, 569
in new-born, 76
Tetanus in new-born, cause of, 76
ice to spine in, 77
prophylactic treatment of, 77
symptoms of, 77
warms baths in, 77
pathology of, 569
prognosis of, 569
symptoms of, 568
treatment of, 569
Tetany, 511
"accoucher's hand" in, 513
causes of, 512
Chvostek's sign in, 514
diagnosis of, 515
Erb's sign in, 514
etiology of, 512
latent, 514
pathologic anatomy of, 515
prognosis of, 516
spasms in, 513
symptoms of, 513
treatment of, 516
Trousseau's sign of, 514
Thorax, size of, in children, 27
table of proportionate sizes of head and, 38
Threadworms, 254
Thrombus neonatorum, 64
Thrush, 159
Thymus gland, physiology of, in children, 27
Tic, 535
convulsif, 517
convulsive, 536
psychic, 536
simple, 536
treatment of, 536
Tics, complex coordinated, 536
Tinea circinata, 777
treatment of, 778
favosa, 778
microscopic examination in, 779
treatment of, 779
kerion, 776
prognosis of, 777
treatment of, 776
tonsurans, microscopic examination in, 776
trichophytina, 775
diagnosis of, 775
etiology of, 775
symptoms of, 776
tonsurans, 775
Toluol solution in diphtheria, 643
Tongue, 165
diseases of the, 165
Tongue-tie, 439
Tonics in subacute milk infection, 211
Tonsillitis, 433
acute, 433

Tonsillitis, acute, causes of, 434
prognosis of, 435
sequelæ of, 436
symptoms of, 434
of lacunar form of, 434
of phlegmonous form of, 434
of simple form of, 434
treatment of, 435
chronic, 437
Tonsils, hypertrophy of, 437
Torsion of spermatic cord, 325
Tracheotomy in diphtheria, 656
Traumatic dermatitis, 743
Tricuspid disease, physical signs of, 416
Trismus, 77
Trousseau's sign of tetany, 514
True croup, 445
Truss in inguinal hernia, 237
in umbilical hernia, 87
Tube, intubation, method of introducing, 660
Tubercular arthritis, 825
disease of testicle, 322
diseases of joints, 824
meningitis, 575
Tuberculosis, 605
bacillus of, 606
mode of infection by, 606
causes of, 606
age in, 606
hereditary predisposition as, 607
susceptibility in, 606
general, 609
of kidney, 317
of lungs, 610
of peritoneum, 252
pulmonary, chronic, 612
climate in, 617
diagnosis of, 614
drugs in, 615
physical signs of, 613
preventive treatment of, 614
prognosis of, 614
symptoms of, 612
treatment of, 614
Tuberculous bronchopneumonia, acute, 610
Tubular nephritis, acute, 303
Tumors, nasal fibrous, 430
of brain and its meninges, 585
causes of, 585
convulsions in, 586
diagnosis of, 588
headache in, 586
optic neuritis in, 586
symptoms of, 585
treatment of, 588
Tumors of brain, vomiting in, 586
of kidney, 318
ovarian, in children, 325
Turpentine eruption, 746
stupe in croupous pneumonia, 480
Tympanites in intestinal obstruction, 232
Typhoid fever, 619
bacillus of Eberth in, 619
baths in, 630
causes of, 619
complications of, 625
diagnosis of, 625
Widal test in, 625
diet in, 628
drugs in, 630
eruption in, 624
fever in, 623
morbid anatomy of, 621
pathology of, 621
preventive treatment of, 627
prognosis of, 627
relapses in, 624
sequelæ of, 625
symptoms of, 622
treatment of, 627
infection, serum-test for, 625

U.

Ulcer of stomach in children, 185
blisters in, 189
causes of, 186
diet in, 189
irrigation in, 189
nutrient enema in, 189
symptoms of, 187
treatment of, 188
Ulcerative proctitis, 242
stomatitis, 158
causes of, 158
hygiene in, 159
symptoms of, 158
treatment of, 159
Umbilical hemorrhage, 69
causes of, 69
ligation in, 69
prognosis of, 69
prophylaxis of, 69
treatment of, 69
hernia, 86
rubber adhesive strips in, 87
treatment of, 87
truss in, 87
polypi, 84
Umbilicus, inflammation of, 76
Undescended testicle, 325
Uric acid, 389
conditions, 389
treatment of, 390

Urine, 284
diacetic acid in, 288
hemoglobin in, 291
in acute Bright's disease, 306
in diabetes mellitus, 386
in scarlet fever, 669
incontinence of, 291
quantity of, secreted in children, 284
in infancy, 30
red blood-corpuscles in, 289
Urticaria, 779

V.

VACCINATION, age to perform first, in child, 687
in smallpox, 685
in whooping-cough, 718
Vaccine crust, 687
inoculation, arm-to-arm, 686
lymph, glycerinized, 686
points, ivory, 686
Vaccinia, 685
history of, 685
technic of inoculation with, 686
Valvulitis, 410
Varicella, 687
causes of, 687
diagnosis of, 688
from variola, 689
from varioloid, 688
eruption in, 688
prognosis of, 689
symptoms of, 688
treatment of, 689
Varicocele, 325
Variola, 680
causes of, 680
complications in, 683
circulatory, 683
dermal, 683
digestive, 683
nephritic, 683
ocular, 683
respiratory, 683
diagnosis of, 684
from varicella, 684
eruption in, 681
confluent form of 682
discrete form of, 681
hæmorrhagica, 682
incubation period in, 681
pathology of, 683
papule in, 683
pustules in, 683
prognosis of, 684
stage of invasion of, 681
symptoms of, 681
treatment of, 685
vaccination in, 685
Varioloid, 682
Venesection in acute diffuse nephritis, 308
Ventricular septum, defect of, 396
Vermiform appendix, position of, in children, 34
Vesicular stomatitis, 157
Virus, varieties of, 686
Visual disturbances in migraine, 560
Volvulus, 230, 235
Wahl's sign of, 235
Vomiting, chronic, 178
cyclic, 183
causes of, 183
diagnosis of, 184
diet in, 184
treatment of, 184
in brain-tumor, 586
in intestinal obstruction, 232
in whooping-cough, 718
Von Graefe's symptom of exophthalmic goiter, 556
Vulvitis, aphthous, in children, 743
Vulvovaginitis, 321
gonorrheal, 321
prognosis of, 321
symptoms of, 321
treatment of, 322

W.

WAHL'S sign of volvulus, 235
Wangenbrand, 161
Warm baths in multiple neuritis, 564
in tetanus in new-born, 77
Wasting, simple, 379
Water-hammer pulse, 415
Waxy kidney, 309
liver, 279
Weaning, 100
gradual method of, 101
Weight, increase of, in children, 17
of brain at birth, 39
of heart at birth, 25
of infant at birth, 17
proportion of, to length in infant and child, 18
table of increase in, 18
Westcott's method of home modification of milk, 137
Wet-nurse, feeding by, 104
White blood, 340
swelling, 825
Whooping-cough, 713
complications in, 715
diagnosis of 716
incubation period in, 713
intubation in, 718
pathology of, 716

Whooping-cough, sequelæ in, 715
symptoms of, 714
treatment of, 716
local, 717
systemic, 717
vaccination in, 718
vomiting in, treatment of, 718
"whoop" in, 714
Widal test for typhoid fever, 625
Winckel's disease, 72
"Witch's milk," 80
Wormian bones, 37
Worms, pin-, 254
Worms, round-, 256
tape-, 259
thread-, 254
Wrist-drop in multiple neuritis, 563

Y.

YELLOW groom, 70

Z.

ZONA, 764

LANE MEDICAL LIBRARY
STANFORD UNIVERSITY
MEDICAL CENTER
STANFORD, CALIF. 94305

P45 Taylor, J.M. 101268
T24 Manual of the diseases
1901 of children.

NAME	DATE DUE